THE NATURE-STUDY IDEA

LIBERTY H. BAILEY

The D. H. Hill Library

North Carolina State College

QH51
B15

Date Due

May16'31
27Mar'48
10Apr'56
DEC 3 1975
DEC 3 1 1975
NOV 23 1977
AUG 24 1983

QH51
B15
21035
Bialey, L. H.
The nature-study idea

DATE
ISSUED TO
May16'31
27Mar48
10Apr'56H
Stains, H.
Steve

21035

THE NATURE-STUDY IDEA

THE NATURE-STUDY IDEA

BEING AN INTERPRETATION OF THE NEW SCHOOL-MOVEMENT TO PUT THE CHILD IN SYMPATHY WITH NATURE

BY

L. H. BAILEY

NEW YORK
DOUBLEDAY, PAGE & COMPANY
1905

Copyright, 1903, by
Doubleday, Page & Company
Published, April, 1903

All rights reserved,
including that of translation into foreign languages,
including the Scandinavian.

CONTENTS

PART I

What Nature-Study Is

		PAGE
I.	What Is Nature-Study?	3
II.	Who Originated the Term Nature-Study?	6
III.	The Meaning of the Nature-Study Movement	14
IV.	The Integument-Man	37
V.	Nature-Study with Plants	43
VI.	The Growing of Plants by Children—The School-Garden	51
VII.	The Agricultural Phase of Nature-Study	62
VIII.	Review	86

PART II

The Interpretation of Nature

		PAGE
I.	The Interpretation of Nature	91
II.	Science for Science's Sake	92
III.	The Extrinsic and Intrinsic Views of Nature	97
IV.	Must a "Use" be Found for Everything?	102
V.	The New Hunting	108
VI.	The Poetic Interpretation of Nature	116
VII.	An Outlook on Winter	124

QH51
B15

PART III

Some Practical Inquiries and Some Ways of Answering Them

PAGE

How Shall I Know What Subjects to Choose? . . 131

But If the Child Choose the Material, the Subject Will Lack Continuity: What Then? 132

Then Would You Give No Heed to Continuity? . . 132

How Shall I Make a Start? 133

Is Not Subject-Matter the First Consideration? . . 134

Would You Teach Heat, Light and Physics as Nature-Study Topics? 135

Would You Teach "Practical" and "Useful" Things? . 135

Would You Teach Objects that the Child Cannot See and Determine for Itself? 136

How Much Apparatus Do I Need? 136

Is It "Thorough"? 137

But Will Not This Nature-Study Be Called Superficial? . 138

But Do You Think That This Nature-Study Will Make Investigators? 138

Will Not This Nature-Study Tend Still Further to Overburden the School? 140

Shall We Teach the Child to Collect, and Thereby to Kill? 141

Would You Tell the Child the Names of the Things? . 141

Would You Begin by First Reading to the Child About Nature? 142

Now That There Are So Many Nature-Books, How Shall I Choose the Most Useful One? 142

How Shall I Acquire Sufficient Knowledge to Enable Me to Teach Nature-Study? 143

PAGE

Is It Best to Have a Professional Nature-Study Teacher to Go from School to School? 145

Should the Parts of a School-Garden Be Apportioned to Pupils, or Should the Work Be Done in Common? . 145

Why Should This Nature-Study Be Confined to the Schools? 150

What Shall We Do with the Children in the Summer Vacation? 151

Will Not This Nature-Study Work Interfere with School Discipline? 152

Shall I Correlate the Nature-Study Work with Other Work? 153

Is Nature-Study on the Wane? 157

Would You Advise Me to Take Up Nature-Study Teaching? 159

PART I

The Nature-Study Idea

I

WHAT IS NATURE-STUDY?

A CONTRIBUTOR to a recent issue of a leading technical journal has endeavored to find a satisfactory answer to the question, "What is nature-study?" by appealing to "eminent scientific men." The answers of these men are printed there in full. Now, the nature-study movement is a product of the common schools, not of scientific investigation. Eminent scientific attainment, as such, is not to be expected to enable persons to give satisfactory answer to the question, for the subject is not in its realm. Happily, many scientific men are also closely in touch with elementary education, and therefore are fully competent to discuss the nature-study movement; but it is this very touch with the common schools, not their eminent scientific achievements, that gives them this competency. Some of the answers referred to above are ideal definitions from the child-teacher's point of view.

To be sure, the term nature-study etymologically implies only the study of nature; and "nature" is, by conventionality, understood to

PROPERTY LIBRARY
N. C. State College

mean the world of outdoor objects and phenomena. But all words and terms mean less or more than their mere etymology would imply, and this meaning is determined by usage. Now usage has determined a definite office for the name nature-study: it designates the movement originating in the common schools to open the pupil's mind by direct observation to a knowledge and love of the common things in the child's environment. It is a pedagogical term, not a scientific term. It is not synonymous with the old term "natural history," nor with "biology," nor with "elementary science." It is not "popular science." It is not the study of nature merely. Nature may be studied with either of two objects: to discover new truth for the purpose of increasing the sum of human knowledge; or to put the pupil in a sympathetic attitude toward nature for the purpose of increasing the joy of living. The first object, whether pursued in a technical or elementary way, is a science-teaching movement, and its professed purpose is to make investigators and specialists. The second object is a nature-study movement, and its purpose is to enable every person to live a richer life, whatever his business or profession may be. Nature-study is a revolt from the teaching of mere science in the elementary grades. In teaching-practice, the work and the methods of the two intergrade, to be sure, and as the high school and college are approached, nature-study passes into science-teaching, or gives way to it; but the ideals are

distinct—they should be contrasted rather than compared.

Nature-study is not science. It is not knowledge. It is not facts. It is spirit. It is concerned with the child's outlook on the world.

Nature-study will endure, because it is natural and of universal application. Methods will change and will fall into disrepute; its name will be dropped from curriculums; here and there it will be encased in the schoolmaster's "method" and its life will be smothered; now and then it will be overexploited; with many persons it will be a fad: but the spirit will live.

So common is the misconception of the meaning and mission of the nature-study movement, that I cannot resist the temptation to bring together in book form a few notes and essays on some of the more salient features of it, even if the resulting book lack somewhat in homogeneity and have some repetitions. These pieces have been written at intervals in the past six years. Most of them were prepared for specific occasions, for the purpose of discussing disputed points or of answering challenges; some have been prepared specially for this collection. Some of them have been published. They are offered in all humility, since every person's view is necessarily colored by his own field of observation; but on the main thesis—that nature-study teaching is one thing and that science-teaching for science's sake is another—I have no hesitation.

II

WHO ORIGINATED THE TERM NATURE-STUDY?

A BRIEF history of the origin of the contemporary nature-study movement will clarify our ideas as to its spirit and purpose. I am aware that the history that follows is incomplete, and that persons who were connected with the beginnings of it are not mentioned; but I believe that the account will be useful in giving us perspective, and in establishing an approximate date for the first use of the term.

I have engaged in a large correspondence for the purpose of discovering something of the history of the nature-study movement. Oftenest, perhaps, I have been referred to the teaching of Agassiz at Penikese as the beginning, at least in this country. Agassiz, however, did not teach nature-study in the special sense in which we use this term, although he gave us the motto, "Study nature, not books." He taught the study of nature by the "natural method." His instruction was given from the investigator's or the specialist's viewpoint, and it was intended primarily for students and adults. The present nature-study movement, as I have said, is a product of the elementary schools, not of universities, although many university and college men have been instrumental

in forwarding it. Cornell was perhaps the first university to take it up as a distinct enterprise (1895), but the movement was already well under way in many places at that time. At this institution it became an extension-teaching movement. Professor C. F. Hodge of Clark University, under the inspiration of Stanley Hall, began popular work in nature-study in 1897.

The nature-study movement is a natural outgrowth of the modern teaching and investigating in what we call natural science. No doubt it has been quickened, as a school subject, by the making of what we know as outdoor books.

Nature-study is not primarily a natural-history subject: it is primarily a pedagogical ideal. Natural-history subjects are the means, not the end. Its beginnings are certainly as old as the time of Socrates and Aristotle. It is a fruit of the great educational reformers—Comenius, Pestalozzi, Jean J. Rousseau, Froebel and the rest. In a large measure, the spirit of our present-day nature-study movement—which seems so new to us—is a recrudescence. Just now it represents a reaction from the dry-as-dust science-teaching.

What we may legitimately call nature-study began to take form in this country from 1884 to 1890. Who first used the term I do not know; and it is of small consequence, because the term may mean much or nothing. The term appears to have been at first a substitute for "object lessons," "plant work," "elementary science," and the like, because it came to be felt that these

things represented mere intellectual ideals and school "methods." Dr. Piez, of the Oswego (N. Y.) Normal School, makes the following comment on the pedagogical origin of the nature-study idea: "I have come to the conclusion that nature-study in spirit, if not in name, is the direct descendant of object teaching. Object teaching aimed at the use of the senses in acquiring knowledge, and was introduced to displace the mechanical 'memory' method current in the schools. It was responsible for raising the problem of method among thoughtful teachers. But the 'lessons on objects' were justly deserving the criticism that they were disconnected, and that the knowledge resulting from them was a knowledge of isolated facts not organized into a comprehensive whole." I will mention a few persons who were early in the field, for the purpose of showing something of the geography and motives of the movement.

Although the teaching of Agassiz may not have been nature-study, as we understand the term, it is undoubtedly true that the present nature-study movement is a proximate result of the forces that he set in motion. A strong application of this influence to school-life was made in Boston by Alpheus Hyatt and Lucretia Crocker. In various places, others of Agassiz's followers carried his spirit into the schools. One of the most powerful early adaptations of his teaching to the common-school work was made at the State Normal School at Oswego, N. Y. There

was a strong Pestalozzian influence in this institution, under the leadership of the late Dr. Sheldon. Professor H. H. Straight went to Oswego in 1876. He had come under the influence of Agassiz and Shaler. He was a student of science, but his views of science teaching in the elementary school underwent gradual but decided change, under the Pestalozzian influence in which he was placed. He saw the insufficiency of "object teaching" as an educational process. The defects he sought to overcome by "correlation of the subjects of study." As director of the practice school, he worked out his ideas of correlation in "nature" subjects and geography subjects. His work included the study of the common things in the neighborhood. In 1883 Professor Straight went to the Cook County (Ills.) Normal School and taught there until his death, in 1886. He had great influence in developing the ideals of this institution, and was given credit therefor by Colonel Parker, the distinguished head of the school. So far as I know, however, Professor Straight did not use the term "nature-study."

The introduction of elementary science as an organic part of school work, ranking with arithmetic and grammar, was made in the Cook County (Ills.) Normal School as early as 1889, under the presidency of Francis W. Parker. This introduction was made by Wilbur S. Jackman, whose teaching and writing in nature-study lines are well known. In 1884 Mr.

Jackman began teaching biology in the Pittsburg High School. During five years' connection with that school he became strongly impressed with the necessity of having a broad foundation laid in the elementary grades for the study of science. The pupils were ignorant of the simplest phenomena that occurred about them. In the spring of 1889 he planned a general course in nature-study and presented it to the Superintendent and the Principals of the ward schools in Pittsburg. It was agreed that in the fall he should have the privilege of meeting the teachers for the purpose of starting this work in the primary and grammar grades. Before the year closed, however, he received an invitation from Colonel Parker to enter the Cook County Normal School and take up the work with him. He entered on the work in the Cook County Normal School in the fall of 1889. During this year (1889) he elaborated the plan already begun, as above outlined. The features which perhaps most distinguished this scheme of nature-study were: (1) That it adopted the apparently irregular plan of using all the material which the "Rolling Year," season by season, brought into the lives of the children; (2) that it rejected the idea of close and specialized study of inert or dead form and sought to place the children in the fields and woods that they might study all nature at work; and (3) that, instead of looking upon nature-study as being supplementary to reading, writing and other forms of expression, nature-study in itself became a demand that these

subjects should be taught. In the fall of 1890 he published bi-monthly pamphlets averaging about 75 pages each, which were called "Outlines in Elementary Science." In the spring of 1891, upon the completion of the series, Henry Holt & Company asked the privilege of reprinting and issuing them in book form. This was done. There was considerable correspondence concerning the name, which resulted finally in the adoption of the term "Nature-Study for Common Schools," and this term has been used continuously ever since.

Another, and an independent, movement started nearly simultaneously in Massachusetts, under the leadership of Arthur C. Boyden, now Vice-Principal of the State Normal School at Bridgewater, Mass. In 1889 a committee was appointed in the Plymouth County Teachers' Association to recommend a plan of introducing nature-study into the schools of the county. For a number of years previous to this time a definite series of lessons on minerals, plants and animals had been taught in the Bridgewater Normal School, and many superintendents and teachers who graduated from the school were teaching the subjects in various parts of the county. It seemed to be the time for a concerted plan of work, and a few persons who were interested in it took this means of starting. An outline for the study of trees was prepared and sent to every school in the county, with provisions for a report from each town at the next annual meeting. This plan was continued for a number of years, and usually an

exhibition of the results was made. The work secured such a good hold that the committee was finally discontinued. In the same year the subject was taught in the institutes, held each fall and spring throughout the State under the auspices of the State Board of Education, and then for ten years Mr. Boyden taught and lectured in these institutes from one end of the State to the other. Printed outlines and illustrated lessons were given. In 1889, also, a department of nature-study was established in the summer school at Cottage City, and Mr. Boyden carried it on till 1901. The definite beginning of the movement, as such, in Massachusetts seems to have been in 1889. At first the work was called "elementary science," but this seemed to be inappropriate, and "nature-study" was suggested. This term seemed to be a good equivalent of the German "Naturkunde"—nature knowledge. On all programmes it was thus printed and quickly secured standing. Shortly after the movement began, the "Conference of Educational Workers" was established. One of the committees had charge of nature-study and met monthly in Boston. Mr. G. H. Martin, Agent of the Board of Education, was chairman, and Mr. Boyden was secretary. They worked out courses of study for distribution, and one year they had a large exhibit from the whole State of the results of the work. These exhibits were common in cities between 1890 and 1895.

About 1889 the term nature-study was used

independently by Frank Owen Payne. He compounded it, using the hyphen at the suggestion of A. N. Kellogg. Mr. Payne began his work in nature-study in 1884, when a teacher in Corry, Pennsylvania. In 1886-1889 he lectured on the subject in Minnesota, and later in New Jersey. Beginning with 1889, he became a regular contributor to the New York School Journal, there using the term nature-study.

Many schools in several States were introducing elementary science in the latter part of the eighties, and it seems that several of them began to use the term nature-study without knowing where or how the term was suggested. The nature-study idea is now widespread and thoroughly established. It marks an epochal change of front in the aims of education, developing the purpose and the means of putting the child into relation with the actual world in which he lives.

III

THE MEANING OF THE NATURE-STUDY MOVEMENT

It is one of the marks of the evolution of the race that we are coming more and more into sympathy with the objects of the external world. These things are a part of our lives. They are central to our thoughts. The happiest life has the greatest number of points of contact with the world, and it has the deepest feeling and sympathy for everything that is. The best thing in life is sentiment; and the best sentiment is that which is born of the most accurate knowledge. I like to make this application of Emerson's injunction to "hitch your wagon to a star"; but it must not be forgotten that one must have the wagon before one has the star. Mere facts are dead, but the meaning of the facts is life. The getting of information is but the beginning of education. "With all thy getting, get understanding."

Of late years there has been a rapidly growing feeling that we must live closer to nature; and we must perforce begin with the child. We attempt to teach this nature-love in the schools, and we call the effort nature-study. It would be better if it were called nature-sympathy.

As yet there are no codified methods of teaching nature-study. The subject is not a formal

part of the curriculum; and thereby it is not perfunctory. And herein lies much of its value —in the fact that it cannot be reduced to a system, is not cut and dried, cannot become a part of rigid school methods. Its very essence is spirit. It is as free as its subject-matter, as far removed from the museum and the cabinet as the skeleton is from the living animal.

It thus transpires that there is much confusion as to what nature-study is, because of the different attitudes of its various exponents; but these different attitudes are largely the reflections of different personalities and the working out of different methods. There may be twenty best ways of teaching nature-study. It is essentially the expression of one's outlook on the world. We must define nature-study in terms of its purpose, not in terms of its methods. It is not doing this or that. It is putting the child into intimate and essential contact with the things of the external world. Whatever the method, the final result of nature-study teaching is the development of a keen personal interest in every natural object and phenomenon.

There are two or three fundamental misconceptions of what nature-study is or should be; and to these we may now give attention.

Fundamentally, nature-study is seeing what one looks at and drawing proper conclusions from what one sees; and thereby the learner comes into personal relation and sympathy with the object. It is not the teaching of science—not the sys-

tematic pursuit of a logical body of principles. Its object is to broaden the child's horizon, not, primarily, to teach him how to widen the boundaries of human knowledge. It is not the teaching of botany or entomology or geology, but of plants, insects and fields. But many persons who are teaching under the name of nature-study are merely teaching and interpreting elementary science.

Again, nature-study is studying things and the reason of things, not about things. It is not reading from nature-books. A child was asked if she had ever seen the great dipper. "Oh, yes," she replied, "I saw it in my geography." This is better than not to have seen it at all; but the proper place to have seen it is in the heavens. Nature-readers may be of the greatest use if they are made incidental and secondary features of the instruction; but, however good they may be, their influence is pernicious if they are made to be primary agents. The child should first see the thing. It should then reason about the thing. Having a concrete impression, it may then go to the book to widen its knowledge and sympathies. Having seen mimicry in the eggs of the aphis on the willow or apple twig, or in the walking-stick, the pupil may then take an excursion with Wallace or Bates to the tropics and there see the striking mimicries of the leaf-like insects. Having seen the wearing away of the boulder or the ledge, he may go to Switzerland with Lubbock and see the mighty erosion of the Alps. Now and then the

order may be reversed with profit, but this should be the exception: from the wagon to the star should be the rule.

Yet again, nature-study is not the teaching of facts for the sake of the facts. It is not the giving of information merely—notwithstanding the fact that some nature-study leaflets are information leaflets. We must begin with the fact, to be sure, but the lesson is not the fact but the significance of the fact. It is not necessary that the fact have direct practical application to the daily life, for the object is the effort to train the mind and the sympathies. It is a common notion that when the subject-matter is insects, the pupil should be taught the life-histories of injurious insects and how to destroy the pests. Now, nature-study may be equally valuable whether the subject is the codlin-moth or the ant; but to confine the pupil's attention to insects that are injurious to man is to give him a distorted and untrue view of nature. A bouquet of daisies does not represent a meadow. Children should be interested more in seeing things live than in killing them. Yet I would not emphasize the injunction, "Thou shalt not kill." Nature-study is not recommended for the explicit teaching of morals. I should prefer to have the child become so much interested in living things that it would have no desire to kill them. The gun and sling-shot and fish-pole will be laid aside because the child does not like them any more. We have been taught that one must make collections if he is to be a naturalist. But collections

make museums, not naturalists. The scientist needs these collections; but it does not follow that children always need them To be taught how to kill is to alienate the pupil's affection and sympathy from the object he is studying. It may be said that it is necessary to kill insects; the farmer had this thought in mind when he said to one of our teachers: "Give us more potato-bug and less pussy willow." It is true that we must fight insects, but that is a matter of later practice, not of education. It should be an application of knowledge, not a means of acquiring it. It may be necessary to have war, but we do not teach our children to shoot their playmates.

Nature-study is not merely the adding of one more thing to a curriculum. It is not coördinate with geography or reading or arithmetic. Neither is it a mere accessory, or a sentiment, or an entertainment, or a tickler of the senses. It is not "a study." It is not the addition of more "work." It has to do with the whole point of view of elementary education, and therefore is fundamental. It is the full expression of personality. It is the practical working out of the extension idea that has been so much a part of our time. More than any other recent movement, it will reach the masses and revive them. In time it will transform our ideals and then transform our methods.

Nature-study stands for directness and naturalness. It is astonishing, when one comes to think of it, how indirect and how unrelated to the lives of

pupils much of our education has been. Geographies begin with the earth, and finally, perhaps, come down to some concrete and familiar object or scene that the pupil can understand. Arithmetic has to do with brokerage and partnerships and partial payments and other things that mean nothing to the child. Botany has to do with cells and protoplasm and cryptogams. History deals with political affairs, and only rarely comes down to physical facts and to those events that have to do with the real lives of the people; and yet political and social affairs are only the results or expressions of the way in which people live. Readers begin with mere literature or with stories of things that the child will never see or do. Of course these statements are meant to be only general, as illustrating what is even yet a great fault in educational methods. There are many exceptions, and these are becoming commoner. Surely, the best education is that which begins with the materials at hand. A child asks what a stone is before it asks what the earth is.

How nature-study may be taught.

There are two ways of interpreting nature—by way of fact and by way of fancy. To the scientist and to the average man the interpretation by fact is often the only admissible one. He may not be open to argument or conviction that there can be any other truthful way of knowing the external world. Yet, the artist and the poet know this world, and they do not know it by

mere knowledge or by analysis. It appeals to them in its moods, not in its details. Yet it is as real to them as to the analyst. Too much are we of this generation tied to mere phenomena.

We have a right to a poetic interpretation of nature. The child comes to know nature through its imagination and feeling and sympathy. Note the intent and sympathetic face as the child watches the ant carrying its grains of sand and pictures to itself the home and the bed and the kitchen and the sisters and the school that comprise the little ant's life. What does the flower think? Who are the little people that teeter and swing in the sunbeam? What is the brook saying as it rolls over the pebbles? Why is the wind so sorrowful as it moans on the house-corners in the dull November days? There are elves whispering in the trees, and there are chariots of fire rolling on the long low clouds at twilight. Wherever it may look, the young mind is impressed with the mystery of the unknown. The child looks out to Nature with great eyes of wonder.

Child with the gray-blue eyes
Gazing so longingly—
Yonder the great world lies—
All is unknown to thee!

Child unwedded to care,
Softly speedeth the hours—
Thou buildest castles in air
And strew'st thy path with flowers.

Build on in thy dreaming,
Nor thy fancies are vain;
The best of life's seeming
Are its castles in Spain!

The good New England poets, did not they know nature? Have they not left us the very essence and flavor of the fields and the woods and the sky? And yet they were not scientists, not mere collectors of facts. So different are these types of interpretation that we all unconsciously do as I did in my last sentence—we set the poet over against the scientist.

Yet poetry is not mere sentiment. The poet has first known the fact. His poetry is misleading if his observations are wrong. Therefore, as I have said, I should begin my nature-study with facts; for facts are tangible, but sentiments cannot be seen. Whatever else we are, we must have the desire to be definite and accurate. We begin on the earth; later, we may drive our Pegasus to a star.

Do not misunderstand. I would not teach nature-subjects in order that the poetic point of view may be enforced. I plead only that the poetic interpretation is allowable on occasion.

How shall nature-study be taught? By the teacher, not by the book. The teacher will need helps. There are books and leaflets that will help him. These publications may be put in the hands of pupils if it is always made plain that the recitation is to be from things which the pupil has seen, not from the book. There can be no text-

book of nature-study, for when one studies a book he does not study nature. Nature-study books and leaflets are guides, not texts. The book should be a guide to the animal or plant: the animal or plant should not be a guide to the book.

The teacher will need help both in methods and in facts. The method, however, is not to be a codified series of laws or a hard-and-fast system; but there should be some underlying pedagogical principle which will run through every item of the work. There will be opportunity for endless variation in the details and in the little applications of the work. The personality of the teacher must always stand out strongly. We need the very best of teachers for nature-study work—those who have the greatest personal enthusiasm, and who are least bound by the traditions of the classroom. The teacher, to be ideal, must have more time, more inspiration and more knowledge. It is better if the teacher have a large knowledge of science, but nature-study may be taught without great knowledge if one sees accurately and infers correctly from the particular subject in hand.

The teacher should studiously avoid starting with definitions and the setting of patterns. Definitions should be the result or summary of the study, not the beginning of it. Mere patterns should only afford means of comparison, and not be regarded as useful in themselves; and even then they are often misleading. The old idea of the model flower is an unfortunate one, simply because the

model flower does not exist in nature. The model flower, the complete leaf, and the like, are inferences; and the pupil should begin with things and not with mere ideas. In other words, the ideas should be suggested by the things, and not the things by the ideas. "Here is a drawing of a model flower," the old method says; "go and find the nearest approach to it." "Go and find me a flower," is the true method, "and let us see what it is."

Two factors determine the proper subjects for nature-study. First, the subject must be that in which the teacher is most interested and of which he has the most knowledge; second, the subject must be that which is commonest and which can be most easily seen and appreciated by the pupil, and which is nearest and dearest to his life. The tendency is to go too far afield for the subject-matter. We are more likely to know the wonders of China or Brazil than of our own brooks and woods. If the subject-matter is of such kind that the children can collect the objects as they come and go from the school, the results will be the better.

With children, begin with naked-eye objects. As the pupil matures and becomes interested, the simple microscope may be introduced now and then. Children of twelve years and more may carry a pocket lens; but the best place to use this lens is in the field. The best nature-study observation is that which is done out-of-doors; but some of it can be made from material brought into the schoolroom.

It is a sound pedagogical principle that the child should not be taught those things that are necessarily foreign to the sphere of its life and experiences. It should not have mere dilutions of science. The young child cannot understand cross-fertilization of flowers, and should not be taught the subject. The subject is beyond the child's realm. When we teach it, we are only translating what grown-up investigators have discovered by means of faithful search. At best, it will only be an exotic thing to the child. Pollen and stamens are not near and dear to the child.

There are three factors in the teaching of nature-study:

(1) The fact,

(2) The reason for the fact,

(3) The interrogation left in the mind of the pupil.

It is impossible to find a natural history object from which these three factors cannot be drawn, for every object is a fact and every fact has a cause, and children may be interested in both the fact and the cause. It may be better, of course, to choose definite subjects, taking pains, at least at first, to select those having emphatic characters. But even in the dullest days of winter sufficient material may be found to keep the interest aflame. A twig or branch may be at hand. There should be enough specimens to supply each child. Let the teacher ask the pupils what they see. The replies will discover the first factor in the teaching—the fact. However, not every fact is signi-

PROPERTY LIBRARY
N. C. State College

ficant to the teacher or to the particular pupils. It remains for the teacher to pick out the fact or answer that is most significant. The teacher should know what is significant and he should keep the point clearly before him. One pupil says that the twig is long; another that it is brown; another that it is crooked; another that it is from an apple tree; another that it has several unlike branchlets or parts. Now, this last reply may appeal to the teacher as a most significant fact. Stop the questioning and open the second epoch in the instruction—the reason why no two parts are alike. As before, from the great number of responses the significant reason may be developed: it is because no two parts have lived under exactly the same conditions. One had more room or more sunlight and it grew larger. The third epoch follows naturally: are there any two objects in nature exactly alike? Let the pupils think about it.

Choose a stone. If similar stones are passed about to the pupils, you ask first for the observation or the fact. One says the stone is long; another, it is light; another, it is heavy; another, that the edges are rounded. This latter fact is very significant. You stop the observation and ask why it is rounded. Some one replies that it is because it is water-worn. Query: Are all stones in brooks rounded? Numberless applications and suggestions can be made from this simple lesson. What becomes of the particles that are worn away? How has soil been formed? How

has the surface of the fields been shaped and molded?

It is not necessary that the teacher always know the reason. He can ask the pupils to find out and report next day. It is the strong teacher who can say: "I do not know." If a problem had been sent to Agassiz or Asa Gray and he had not understood it, would he have dissimulated or have evaded in the answer? Would he not have said boldly "I do not know"? Such men delve for knowledge, but for every fact that they discover they turn up a dozen mysteries. Knowledge begins in wonder. The consciousness of ignorance is the first result of wonder, and it leads the pupil on and on: it is the spirit of inquiry.

These illustrations are given merely as examples. They may not be ideal, but they show what can be done with very common material. In fact, the surprise and interest is often all the greater because the objects are so very common and familiar.

To my mind, the best of all subjects for nature-study is a brook. It affords studies of many kinds. It is near and dear to every child. It is an epitome of the nature in which we live. In miniature, it illustrates the forces which have shaped much of the earth's surface. It reflects the sky. It is kissed by the sun. It is rippled by the wind. The minnows play in the pools. The soft weeds grow in the shallows. The grass and the dandelions lie on its sunny banks. The moss

and the fern are sheltered in the nooks. It comes from one knows not whence: it flows to one knows not whither. It awakens the desire to explore. It is fraught with mysteries. It typifies the flood of life. It "goes on forever."

In other words, the reason why the brook is such a perfect nature-study subject is the fact that it is the central theme in a scene of life. Living things appeal to children. To relate the nature-study work to living animals and plants is the fundamental idea in Hodge's ideal, as expressed, for example, in his book, "Nature-Study and Life." He holds that the appreciation of inanimate things is a later development in the child-life than an appreciation of objects that are living. He would, therefore, not begin with weathering of rock and formation of soil, combustion and the like, although he would "not wish to insinuate that the study of living things is all of nature-study." With this I agree for the very young, and I would study a brook or a fence-corner or a garden-bed or a bird or a plant. However, the teacher and the way of teaching are more important than the subject matter, and there are good nature-study teachers who are better fitted to teach inanimate than animate subjects.

One of the first things that a child should learn when he comes to the study of natural history is the fact that no two objects are alike. This leads to an apprehension of the correlated fact that every animal and plant contends for an opportunity to live, and this is the central fact in the study of

living things. The world has a new meaning when this fact is understood. This is the key that unlocks many mysteries, and it is the means of establishing a bond of sympathy between ourselves and the world in which we live.

It is a common mistake to attempt to teach too much at every exercise; and the teacher is also appalled at the amount of information which he must have. Suppose that one teaches two hundred and fifty days in the year. Start out with the determination to drop into the pupils' minds two hundred and fifty suggestions about nature. One suggestion is sufficient for a day. Let them think about it and ponder over it. We stuff our children so full of facts that they cannot digest them. I should prefer ten minutes a day of nature-study to two hours; but I should want it quick and sharp. I should want it designed to develop the observing and reasoning powers of the child and not to give mere information. It should be vivid and spontaneous. Spirit counts for more than knowledge.

Taught in this way, nature-study work is not an additional burden to the teacher, but a relief and a relaxation. It may come at the opening of the school hour, or at the close of a hard period, or at any other time when an opportunity offers. It can often be combined with the regular studies of the school, and in that way it can be introduced in places where it would otherwise meet with objection. For example, the subject-matter of the lesson may be used for the exercise in drawing or

in geography. Let the child draw the twigs; but always be careful lest the drawing become more important than the twigs.

What may be the results of nature-study?

Its legitimate result is education—the developing of mental power, the opening of the eyes and the mind, the civilizing of the individual. As with all education, its central purpose is to make the individual happy; for happiness is nothing more nor less than pleasant and efficient thinking. It is often said that the ignorant man may be as happy as the educated man. Relatively, this is true; absolutely, it is not. A ten-foot well is not so deep as a twenty-foot well; and although the ten-foot well may be full to the brim, it holds only half as much water as the other.

The happiness of the ignorant man is largely the thoughts born of physical pleasures; that of the educated man is the thoughts born of intellectual pleasures. One may find comradeship in a groggery, the other may find it in a dandelion; and inasmuch as there are more dandelions than groggeries (in most communities), the educated man has the greater chance of happiness.

Some persons object to nature-study because it is not systematic and graded. They think that it leads to disjunctive and discursive work. My first answer is that the discursiveness may be its charm. Thereby comes the contrast with the perfunctory school work; and thereby, also, arises its naturalness. Again, I answer that nature-study

exercises are not to be the dominant work in the school. They are, or should be, only incidental. The formal school work will supply the drill in method and system; nature-study will afford relaxation, and it will be valuable because it is short and forceful. But, as a matter of fact, nature-study will nearly always be consecutive in subject-matter because the teacher will feel himself most competent in one or two lines and will devote himself chiefly to them; or the consecutiveness may be that of the seasons, following the wild life of the neighborhood. The gist of it all is that the mere exercises in nature-study are only a means to an end: it is the nature-study spirit, not that exercise nor this, that is to correct and to enliven educational ideals. The given exercise may be secondary to other subjects of the school day, but the point of view—the way of thinking—that it inculcates is fundamental and will pervade the school or the home.

My remarks on methods are meant, of course, to apply to children. As the pupil advances, the work will naturally become more systematic, until, in the high school, it may develop into science-teaching. Those who complain that nature-study is desultory are really thinking of science, not of nature-study. Although not the teaching of science, as such, nature-study is not unscientific.

Nature-study not only educates, but it educates nature-ward; and nature is ever our companion, whether we will or no. Even though we are determined to shut ourselves in an office, nature

sends her messengers. The light, the dark, the moon, the cloud, the rain, the wind, the falling leaf, the fly, the bouquet, the bird, the cockroach —they are all ours.

If one is to be happy, he must be in sympathy with common things. He must live in harmony with his environment. One cannot be happy yonder nor to-morrow: he is happy here and now, or never. Our stock of knowledge of common things should be great. Few of us can travel. We must know the things at home.

Nature-love tends toward naturalness, and toward simplicity of living. It tends country-ward. One word from the fields is worth two from the city. "God made the country."

I expect, therefore, that much good will come from nature-study. It ought to revolutionize the school life, for it is capable of putting new force and enthusiasm into the school and the child. It is new, and therefore is called a fad. A movement is a fad until it succeeds. We shall learn much, and shall outgrow some of our present notions, but nature-study has come to stay. It is in much the same stage of development that manual-training and kindergarten-work were twenty-five years ago. We must take care that it does not crystallize into science-teaching on the one hand, nor fall into mere sentimentalism on the other.

I would again emphasize the importance of obtaining our fact before we let loose the imagination, for on this point will largely turn the results—the failure or the success of the movement.

We must not allow our fancy to run away with us. If we hitch our wagon to a star, we must ride with mind and soul and body all alert. When we ride in such a wagon, we must not forget to put in the tail-board.

Another most important result of the nature-study movement will be its effect, along with manual-training and other forces, in gradually overturning present systems of schoolwork. The system of memorizing from books will eventually have to go. The pupil will first be put into sympathetic contact with objects, not put into books. In many ways we are now in a transition period in our school systems. For one thing, we are living in an era of the material equipment of schools—the erecting of magnificent buildings, the gathering of extensive outfits. This is true of colleges and universities as well as of the common schools. When this era is past, we shall have more money to spend for teachers. Teaching will be a profession requiring better training and commanding more pay, and men teachers will come back to it.

In this evolved and emancipated school, the nature-study spirit will prevail, even though the name itself be lost. This spirit stands for naturalness and the natural method, for freedom, spontaneity, individual initiative, because it deals first-hand with actual things. It stands for doing and accomplishing. It is the active and creative method. It is a developing of the powers of the pupil, not hearing him recite. In spirit and

method it is opposed to the pouring-in-and-dipping-out process.

My own work in nature-study centers chiefly about its value as a means of improving country living. It may tend distinctly toward the improvement of the farmer, and thereby of farming. Go into a potato-growing community and ask the farmers where the roots of the potato plants are—whether above or below the tubers—and you will puzzle them nearly every time. And yet, a knowledge of the position of the roots is essential to the best potato-growing, for upon this position depend in part the principles governing the depth of planting, hilling, and, to some extent, of tilling. At a farmers' meeting in an apple-growing section, I asked how many apple flowers are borne in a cluster. Every man guessed, but no man knew. One man said that the limbs of some of his apple trees had died; he asked me why. I asked him the symptoms: but he did not know as they had any symptoms—they had only died. Had he looked at the limbs? Yes, he had seen them from the barnyard!

Now, I do not care whether nature-study teaches where the potato roots are or not. The point is, that nature-study teaches the importance of actually seeing the thing and then of trying to understand it. The person who actually knows a pussy-willow will know how to become acquainted with the potato-bug. He will introduce himself.

In recent years there has been great activity in disseminating information amongst the farmers.

The results have been gratifying. Not only have farmers learned more, but there has been a general uplift in the tone of many rural communities. But the discouraging fact is, that the young people do not often come to the farmers' meetings in any numbers. There will be a constantly recurring crop of ignorance and prejudice. Each crop, to be sure, must be above its predecessor, but yet not living up to the full stature of its opportunities. It is therefore necessary to begin with the new generation—to begin our chimney at the bottom, rather than at the top. People crowd into the cities largely because of the intellectual entertainment that they find there. If their own intellectual horizon is enlarged, they may find entertainment in the country.

The teacher, the clergyman, the progressive merchant or farmer here and there, are the persons that are willing to help along the work of uplifting the rural communities. Education is the only salvation for the farmer—not the development of facts merely, but the development of power through the enlargement of capability. The results will come slowly. We must not be impatient. There are centuries of inertia to be overcome. The best and most permanent things are of slow growth.

Nature-study teaching may seem to be an indirect way of reaching the farmer; but it is not. It is direct because it strikes at the very root of the difficulty. One of the pleasantest comments which we have had on our nature-study work

came from a country teacher who said that because she had used it her pupils were no longer ashamed of being farmers' children. If only that much can be accomplished for each country child, the result will be enough for one generation. What can be done for the country child can be done, in a different sphere, for the city child. Fifty years hence the harvest will be seen.

The nature-study effort sets our thinking in the direction of our daily doing. It relates the school-room to the life that the child is to lead. It makes the common and familiar affairs seem to be worth the while. Essentially, it is not an ideal for the school any more than it is for the home; but so completely do we delegate all work of teaching and instructing to the school, that nature-study effort comes to be, in practice, a school-room subject. I wish that every parent, as well as every professional teacher, could see the importance of first instructing the child in the very things that it is doing and the very objects that it is seeing. The ideal of the parent or the teacher should be to bring the child into sympathetic relations with its world; but whatever may be in the mind and hope of the teacher, so far as the child is concerned the nature-sympathy must come as a natural effect of actual observation of definite objects and phenomena.

If, in conclusion, I were asked for a condensed statement of the nature-study idea, I should choose the following definition of it by Professor Thomas H. Macbride, of the University of Iowa: "I

should say that by nature-study a good teacher means such study of the natural world as leads to sympathy with it. The keynote, in my opinion, for all nature-study is sympathy. Such study in the schools is not botany; it is not zoölogy; although, of course, not contravening either. But by nature-study we mean such a presentation, to young people, of the outside world that our children learn to love all nature's forms and cease to abuse them. The study of natural science leads, to be sure, to these results, but its methods are long and have a different primary object."

IV

THE INTEGUMENT-MAN

I WROTE a nature-study leaflet on "How a Squash Plant Gets Out of the Seed." A botanist wrote me that it were a pity to place such an error of statement before the child: it should have read, "How the Squash Plant Gets Out of the Integument."

Of course my friend was correct: the squash plant gets out of an integument. But I was anxious to teach the essence of the squash plant's behavior, not a mere verbal fact—and what child was ever interested in an integument?

It is the old question over again—the question of the point of view and what one is driving at. The method of presentation must first be adapted to the person to be instructed, else the instruction will be of little consequence. A person may be so intent on mere literal accuracy that he overlooks the matters that are really important and even vital.

It is the fear of the Integument-Man that keeps many a good teacher from teaching nature-study. He is afraid that he will make a mistake in statements of mere fact. Now, the person who is afraid of making a mistake is the very person to trust, because he will be careful. Of course he will make mistakes—every one does who really

accomplishes anything; but the mistakes will be relatively few: he will at once admit the mistakes and correct them when they are discovered, and the pupils will catch his desire for accuracy and admire the sincerity of his purpose. Pity the man who has never made an error!

The teacher often hesitates to teach nature-study because of lack of technical knowledge of the subject. This is well; but technical knowledge of the subject does not make a good teacher. Expert specialists are so likely to go into mere details and to pursue particular subjects so far, when teaching beginners, as to miss the leading and emphatic points. They are so cognizant of exceptions to every rule that they qualify their statements until the statements have no spirit and no force. There are other ideals than those of mere accuracy. In other words, it is more important that the teacher be a good teacher than a good scientist. One may be so exact that his words mean nothing. But being a good scientist ought not to spoil a good teacher.

The Integument-Man sees the little things. The child sees the big things. Ask a child to describe a house, or to draw one.

The Integument-Man teaches details, and his teaching is "dry." The child wants things in the large; when it gets into the high school or college it may carry analysis and dissection to the limit.

The Integument-Man teaches science, although it is not necessarily the best science. The child wants nature.

The Integument-Man believes that any work, to be of value, must be accurate; and accuracy in nature-study begets accuracy in science, when the pupil takes it up later on. So do I. But the child can be accurate only so far as it can understand and comprehend: it must work in its own sphere; integuments are not in the child's sphere.

The Integument-Man is fearful of every word that seems to imply motive or direction in plants and the lower animals. "The roots go here and there in search of food" is wrong because roots do not "go." Seeds do not "travel." Plants do not "prepare" for winter. I wonder, then, whether water "runs" or winds "blow." This mere verbal accuracy forgets that words are only metaphors and parables, their significance determined by custom, and that the essential truth is what we should search for—expressing it, when found, in language that is alive, unmistakable, and conformed to best usage.

The Integument-Man insists on "methods." The other day a young man wanted me to recommend him as a teacher of one of the sciences in a public school. He explained that he had had a complete course in this and in that; he could teach the whole subject as laid down in the books; he knew the methods. It was evident that he was well drilled. He had acquired a fund of well-digested but unrelated facts. These facts were carefully assorted and ticketed, and tucked away in his mental cupboard as em-

broidered napkins are laid away in a drawer. Poor fellow! Mere details have little educative value. An imperfect method that is adapted to one's use is better than a perfect one that cannot be used. Some school laboratories are so perfect that they discourage the pupil in taking up investigations when thrown on his own resources. Imperfect equipment often encourages ingenuity and originality. A good teacher is better than all the laboratories and apparatus.

I like the man who has had an incomplete course. A partial view, if truthful, is worth more than a complete course, if lifeless. If the man has acquired a power for work, a capability for initiative and investigation, an enthusiasm for the daily life, his incompleteness is his strength. How much there is before him! How eager his eye! How enthusiastic his temper! He is a man with a point of view, not a man with mere facts. This man will see first the large and significant events; he will grasp relationships; he will correlate; later, he will consider the details. He will study the plant before he studies the leaf or germination or the cell. He will discover the bobolink before he looks for its toes. He will care little for mere "methods."

The Integument-Man is afraid that this popular nature-study will undermine and discourage the teaching of science. Needless to say, the fear is absurdly groundless. Science-teaching is a part of the very fabric of our civilization. All our goings and our comings are adjusted to it. No

sane man wishes to cheapen or discourage the teaching of science. Nature-study is not opposed to it. Nature-study prepares the child to receive the science-teaching. Gradually, as the child matures, nature-study may grow into science-learning if the child so elect. Science-teaching has more to fear from desiccated science-teaching than it has from nature-study. Everything that is true and worth the while will endure.

All youths love nature. None of them, primarily, loves science. They are interested in the things that they see. By and by they begin to arrange their knowledge and impressions of these things, and thereby to pursue a science. The idea of the science should come late in the educational development of the youth, for the simple reason that science is only a human way of looking at a subject. There is no natural science, but there has arisen a science of natural things. At first the interest in nature is an affair of the heart, and this attitude should never h stifled, much less eliminated. When the interest passes from the heart to the head nature-love has given way to science. Fortunately, it can always remain an affair of the heart with a most perfect engraftment of the head, but the teaching of facts alone tends to divorce the two. When we begin the teaching of the youth by the teaching of a science we are inverting the natural order. A rigidly graded and systematic body of facts kills nature-study; examinations bury it.

Then teach! If you love nature and have

living and accurate knowledge of some small part of it, teach! Your reputation is not to be made as a geologist or zoologist or botanist, but as a teacher. When beginning to teach birds, think more of the pupil than of ornithology. The pupil's mind and sympathies are to be expanded: the science of ornithology is not to be extended. Remember that spirit is more important than information. The teacher who thinks first of his subject teaches science; he who thinks first of his pupil teaches nature-study. With your whole heart, teach!

Do not be afraid of the Integument-Man.

V

NATURE-STUDY WITH PLANTS

Any one who has listened to discussions in the recent meetings of teachers and scientists must have been impressed with the great prominence which is given to nature-study. The nature-study movement is now, perhaps, the most conspicuous new feature in educational ideals in the secondary and primary schools. All the so-called natural sciences are contributing to the movement. The methods in plant-study, however, show a distinct development in pedagogical ideas which it may be well to recapitulate. One can make out four fairly well marked epochal ideals in the teaching of plant subjects.

First, was the effort to know the names of plants and to classify the kinds. This was a direct reflection of the systematic or classificatory studies of the botanists. The external world had been unknown as to its details, and botanists necessarily attempted inventories of the plant kingdom. Plants must be collected and named. From this impulse arose the herbarium collecting, a method of teaching which was so thoroughly impressed into school methods a generation or two ago that it is still a troublesome factor in many places.

The second stage in plant-study in the American

schools was the desire to know the names of the parts of plants. It came with the excellent text-books of Asa Gray and others, in which the results of studies in morphology and physiology and histology were codified and defined. These books were nearly as rigid in their systems and methods as text-books of physics; and the pupil recited mostly from the book, with perhaps some accessory observation on plants.

The third epoch is that of training for independent investigation. In very recent times, and chiefly since the death of Gray nearly two decades ago, the German laboratory methods have been widely copied in America by the many young and brilliant botanists who have studied abroad. As a result there are many high schools which are equipped with microscopes and apparatus that would have done credit to a college or university twenty-five years ago. The laboratory method is a distinct advance on the preceding methods of teaching in the fact that the pupil actually studies plants; but its motive and point of view are distinctly wrong for the elementary school from the fact that it attempts primarily to teach botany rather than to educate the pupil. The field of view is also very narrow, and the pupil's mind is likely to be closed to nature and restricted in its range. The stage of the microscope and the tables of the laboratory are poor and narrow ranges for the young mind when there are fields and gardens adjacent. The German laboratory method is no doubt ideal for the teaching of botany to investi-

gators and specialists, but it lacks the inspiration and the educative impulse which young minds need.

The fourth epoch is marked by the effort to know the plant as a complete organism living its own life in a natural way. It is marked by a new and vital plant physiology. In the beginning of this epoch we are now living.

The pupil should come to the study of plants and animals with little more than his natural and native powers. Study with the compound microscope is a specialization to be made when the pupil has had experience and when his judgment and sense of relationships are trained.

A difficulty in the teaching of plants is to determine what are the most profitable topics for consideration. The trouble with much of the teaching is that it attempts to go too far and the subjects have no vital connection with the pupil's life. Good botanical teaching for the young is replete with human interest. It is connected with the common associations.

Plants always should be taught by the "laboratory method": that is, the pupil should work out the subjects directly from the specimens themselves; but I should want it understood that the best "laboratory" may be the field.

Specimens mean more to the pupil when he collects them. No matter how commonplace the subject, a specimen will vivify it and fix it in the pupil's mind. A living, growing plant is worth a score of herbarium specimens.

In the secondary schools botany should be taught for the purpose of bringing the pupil closer to the world with which he lives, of widening his horizon, of intensifying his hold on life. It should begin with familiar plant forms and phenomena. It should be related to the experiences of the daily life. It should not be taught for the purpose of making the pupil a specialist: that effort should be retained for the few who develop a taste for special knowledge. It is often said that the high school pupil should begin the study of botany with the lowest and simplest forms of life. This is wrong. The microscope is not an introduction to nature. It is said that the physiology of plants can be best understood by beginning with the lower forms. This may be true: but the customary technical plant physiology is not a subject for the beginner. Other subjects are more important. The youth is by nature a generalist. He should not be forced to be a specialist.

Just what kind of plant or animal subjects should be taught must depend (1) on the desires and capabilities of the teacher; (2) on the place in which the school is—whether city or country, North or South, prairie or mountain—for it is important that the subject be common and have relation to the lives of the pupils; (3) on the desires of the pupils, particularly if they are to do the collecting; (4) on the time of the year.

Whenever possible, let the pupil first come into cognizance of the plant as a whole. It is well to choose one species of plant that is common and

familiar, then endeavor to determine where it grows, why it grows there, how it is modified in different circumstances. If it is a dandelion, one lesson may be devoted to dandelions in the schoolyard; another to dandelions in the meadow; another to dandelions along hard and dry roadsides; another to dandelions in rich farmyards and gardens; another to dandelions in the borders of woodlands. Compare the relative abundance of dandelions in these different places: why? Do the plants "look" the same in these different places: how differ and why? (Note the size and form of plants, relative number of leaves, form and size of leaves, root habit, abundance of bloom, length of flower stems.)

Having known one kind of common plant, the pupil may well study plant societies—how plants live together, and why. Every distinct or separate area has its own plant society. There is one association for the hard-tramped dooryard—knotweed and broad-leaved plantain with interspersed grass and dandelions; one for the fence-row—briers and choke-cherries and hiding weeds; one for the dry open field—wire-grass and mullein and scattered docks; one for the slattern roadside—sweet clover and ragweed and burdock; one for the meadow swale—smartweed and pitchforks; one for the barnyard—rank pigweeds and sprawling barn-grass; one for the dripping rock-cliff—delicate bluebells and hanging ferns and grasses. Indefinitely might these categories be extended. We all know the plant societies, but we have not thought

of them. In every plant society there is one dominant note. It is the individuality of one kind of plant which grows most abundantly or overtops the others. Certain plant-forms come to mind when one thinks of willows, others when he thinks of an apple orchard, still others when he thinks of a beech forest. The farmer may associate "pussly" with cabbages and beets, but not with wheat and oats. He associates cockle with wheat, but not with oats or corn. We all associate dandelions with grassy areas, but not with burdocks or forests. It is impossible to open one's eyes out-of-doors outside the paved streets of cities without seeing a plant society. A lawn is a plant society. It may contain only grass, or it may contain weeds hidden away in the sward. What weeds remain in the lawn? Only those which can withstand the mowing. What are they? Let a bit of lawn grow as it will for a month and see what there is in it. A swale, a dry hillside, a forest of beech, a forest of oak, a forest of hemlock or pine, a weedy yard, a tangled fence-row, a brook-side, a deep quiet swamp, a lake shore, a railroad, a river bank, a meadow, a pasture, a dusty roadway—each has its characteristic plants. Even in the winter one may find these societies—the tall plants still asserting themselves, others of less aspiring stature, and others snuggling just under the snow.

Later, special attributes or forms of plants may be considered—forms of stems, bark, ways of branching, root forms, leaf forms, position and size of leaves with reference to light, flower forms,

falling of the leaves, germination, seed dispersal, pollination (for older pupils), injuries of various kinds (as by snow, ice, wind, sun-scalding, drought, insects, fungi, browsing by cattle), simple physiological experiments. In winter, studies may be made of the forms of trees and bushes and of persisting weeds, leaf-buds and fruit-buds, bark forms, preparation for spring, tubers and bulbs, seed-sowing and germination, struggle for existence in the tree-top, evergreens and how they shed their leaves, how the different kinds of trees hold the snow, where the herbs and tender things are, cones and seed pods, apples and turnips and other things from the cellar, knots and knot-holes, how vines hold to their supports, and others. These subjects are intended only as the merest suggestions of the kind of work that may be taken up with profit. As far as possible, the study of form and function should go together. Correlate what a part is with what it does. What is this part? What is its office, or how did it come to be? It were a pity to teach phyllotaxy without teaching light-relation: it were an equal pity to teach light-relation without teaching phyllotaxy.

There are those who discourage the teaching of plant societies until the pupil is well grounded in "physiology"; but this, again, is the science-teaching point of view—and it may be the correct point of view for college work. Of course the child cannot understand the fundamental reasons for plant association—I wonder whether the botanist does?—but the child can comprehend the

phenomena, and he will be interested in them because they are so intimately associated with his life.

There are those, again, who say that such subjects as those suggested above do not prepare the pupil to enter college. My reply is that the elementary schools do not exist for the sake of the college or the university. Those that are to enter college are a small and special class, and they may receive special instruction.

VI

THE GROWING OF PLANTS BY CHILDREN—THE SCHOOL-GARDEN

ACTUALLY to grow a plant is to come into intimate contact with a specific bit of nature. The numbers of plants that we grow, and also the kinds of them, increase with every generation. The intensity of our plant-growing, as well as the increasing care for animals, is coming to be a measure of our interest in the world about us.

Not only has the cultivation of plants itself increased our contact with plants and with nature, but, in connection with the growth of the spirit of art, of sport and of suburbanism, it has taken us afield and has impelled us to know things as they are and as they grow. All this great interest in nature is reacting profoundly on the natural sciences in making them more vital and increasing their application to the daily life. With all its progressiveness, science is yet conservative. The modern popularization of plant-knowledge is probably due quite as much to these agencies as to the progress of botany itself.

There are many practical applications to the lives of children and to the home that can be made from a knowledge of plants and horticulture. This knowledge means more than a mere know-

ledge of plants themselves. It takes one into the open air. It enlarges his horizon. It brings him into contact with living things. It increases his hold on life. All these facts were well understood by Froebel, Pestalozzi and other educational reformers. It is important that one does not assume too much when beginning plant-work with children. We forget that things which fail to appeal to us, because of our busy lives and great experience, may nevertheless mean very much to the child. Often we attempt to teach the child so much that it is confused and nothing makes an impression. An interest in one simple, living problem that is near to the child's life is worth a whole book of facts without nature.

It is not primarily important that children know the names, although the name is an introduction to a plant as it is to a person. The essential thing is that there should be plants about the home, or in the school grounds, or in the schoolhouse windows. Even though the children are not conscious that they are receiving any impression from these plants, nevertheless the very presence of them has an influence which will be felt in later life, even as the presence of good literature and furniture and the association of refined surroundings have influence on the life of the individual.

> I dropped a seed into the earth. It grew, and the plant was mine.
>
> It was a wonderful thing, this plant of mine. I did not know its name, and the

plant did not bloom. All I know is that I planted something apparently as lifeless as a grain of sand and there came forth a green and living thing unlike the seed, unlike the soil in which it stood, unlike the air into which it grew. No one could tell me why it grew, nor how. It had secrets all its own, secrets that baffle the wisest men; yet this plant was my friend. It faded when I withheld the light, it wilted when I neglected to give it water, it flourished when I supplied its simple needs. One week I went away on a vacation, and when I returned the plant was dead; and I missed it.

Although my little plant had died so soon, it had taught me a lesson; and the lesson is that it is worth while to have a plant.

Have some little means of growing plants, not only to teach how to grow plants themselves, but to teach the child the care of things, to show that other beings besides itself have vicissitudes and lives of their own, and to implant the germ of altruism—the interest in something outside of oneself. These means of growing plants should be simple. A pot, a box or a hotbed may be sufficient. Every child should have the handling of at least one plant during the period of childhood. One plant cannot be handled without leaving an impress on the life.

The love of plants must be inculcated in the school. In nearly every school it is possible to have a few plants in the window. They may not

thrive, but it is worth while to set the children to inquiring why they do not. Sometimes the poorest plants awaken the most effort and inquiry. If nothing else will thrive, a beet will. Secure a good fresh beet from the cellar. Plant it in a box or tin can. Surprisingly quick it will throw out clean bright leaves. The thick root will hold moisture from Friday to Monday.

A desire for school-gardens is gradually taking shape. This movement must grow and ripen; it cannot be perfected in a day. We must be patient and persistent. For a century there have been few school-gardens: we must not expect to overcome the custom in a day. The movement has not been aided much, if at all, by those who have "complete" schemes for gardens for the district schools. Such schemes may be talked about later. For the present, start the work by suggesting that the school-grounds be cleaned or "slicked up." Take one step at a time. The propaganda for school-gardens must have relation to the economic and social conditions under which the school exists. There is some confusion as to the objects of school-ground improvement. The purposes may be analyzed as follows:

(1) Ornamenting the grounds, comprising (*a*) cleaning and tidying them, (*b*) securing a lawn, (*c*) planting. This is always the first thing to be done. It stands for ideals of thrift, cleanliness, comfort, beauty, progressiveness.

(2) Establishing a collection to supply material for nature-study and class work.

(3) Making a garden for the purpose of (*a*) supplying material (as in No. 2,) (*b*) affording manual training, object lessons and instruction in plant-growing, (*c*) teaching agriculture and horticulture.

These categories are referable to two main ideas in school-gardening: (1) The improvement or adornment of the grounds; (2) the making of distinct gardens for purposes of direct instruction, or school-gardening proper. Much of the current discussion does not distinguish these two ideals, and thereby arises some of the loss of effort and effectiveness in the movement.

The first category—the improvement of the premises—is of universal application. Every school-ground can be picked up, slicked up and made fit for children to see. There are three stages or epochs in the improvement of any ground: Cleaning up; grading and seeding; planting.

To improve the school-grounds should be a matter of neighborhood pride. It is an expression of the people's interest in the things that are the people's. We are ashamed when our homes are not fit and attractive for children to live in. But who cares if at the school the fence is tumble-down, the wood or coal scattered over the yard, the clapboards loose, the chimneys awry, the trees broken, the outhouses sagged and yawning?

The first thing to do is to arouse the public conscience. Begin with the children. As soon as they are directed to see the conditions they will believe what they see. They are not prejudiced. They will talk about it: teacher, mother, father will hear.

The next thing to do is to "clean up." Do not begin with any ideal plan of landscape-gardening improvement to be carried out at once—not unless some one person is willing to do all the work and bear all the expense out of his public spirit; and even this would be unfortunate, because most of the value in improving a ground is to interest the children in the work. Get the children enthusiastic—it is easy to do—in removing stones and litter and rubbish, in filling the holes, piling the wood, raking the grounds. If one school year were required to accomplish this work alone it would be time well used. Children and teachers have many interests. We are likely to expect too much of them.

The cleaning up once done, and the civic pride once aroused to the pitch of keeping it done, the next thing to do is to make a base or foundation upon which all the gardening or planting features are to stand: the land must be graded. In some cases the soil must be removed and new soil put in its place, for the soil about a schoolhouse is very likely to be poor sand or clay, or a mixture with building material and other rubbish; but in general this labor will not be necessary if only a lawn and ornamental planting are desired. In

some instances a lawn is impracticable, but a good and even earth surface should always be secured. The early spring is the season in which to do all this shaping and seeding of the land. The spring fever is on and enthusiasm is new-born. If the school is in the country, the farmers can be interested to do the heavy work. If the subject has been well discussed in the school for some weeks or months, it should not be difficult to organize the farmers into a "bee" to grade, till and seed the ground. There is always at least one energetic man in the community who is ready to take the lead in such movements as this. Much of the value of improving the school-ground lies in the arousing of public interest in public questions.

The next year, plant. Let the matter be discussed in school. Ask the children to make plans. When the time is ready, choose the simplest plan that seems to fulfil the requirements. Remember that during a large part of the year the school-ground will be practically without care. The planting must be able to maintain itself, if necessary. Leave the centers open. Throw the planting mostly to the borders or margins. Avoid all elaborate designs in bedding. Be careful not to have scattered effects in planting. Have the planting as little and as simple as possible and yet accomplish the desired results. Leave ample space for playgrounds. Cover the out-buildings with vines, and screen them with bushes and trees. Use chiefly of hardy and well-known trees and shrubs and herbs. Aim to have the ground

interesting because it appeals to the onlooker as a picture as a whole and not as a collection of plants.

The real school-garden is a different idea from all this. The school-garden is for purposes of direct instruction. It is an outdoor laboratory. It is a part of the school equipment, as books, blackboards, charts and apparatus are. The real school-garden is not adapted to all schools; or, to speak more correctly, not all schools are yet adapted to the school-garden, any more than they are all adapted to an equipment in physics or chemistry. All grounds can be improved and embellished; we shall be glad when all schools will also have a school-garden. The improvement of the grounds is the first consideration: that is primarily a question of civic pride. The making of a definite garden is an epoch in the life of each school: it marks the progress of the school in pedagogical ideals.

The school-garden should have a special area set aside for it, as any other garden or laboratory has. Its prime motive is not to be ornamental, but to be useful. The ground should be "good," well prepared, well tilled. The garden should be a good garden, if it is to do its best work.

Just now there is much interest in school-gardening in the United States. This interest is the beginning of a new movement which will take the pupil out-of-doors and to nature, and will relate his school life to his real life. The primary effort should be to arouse the public conscience

to the importance of caring for the school premises and to the necessity of bringing the child into sympathy with its environment. Then, here and there, the school-garden, for purposes of definite instruction, will be instituted. In the country districts the school-garden will come slowly, because gardens are so common as to lose their interest, and because the rural schools are often small and weak. Higher ideals of agriculture at home, nature-study in the school, consolidation of weak districts—these are the means that will bring the real school-garden to the rural school.

But there is a broader significance to the growing of plants than that associated with mere gardening or with the furnishing of schoolroom material alone. There are national aspects. Children in the home and school should be interested in horticulture and agriculture as a means of introduction to nature. Farming introduces the human element into nature and thereby makes it more vivid in the child's mind. More than half the people of the United States live outside the cities. More people are engaged in farming than in any other single occupation. The children in the schools are taught much about the cities, but little about the farming country. The child should be taught something from the farmer's point of view. This will broaden the child's horizon and quicken his sympathies. Every person is now supposed to know something of the country. He will spend part of his vacations therein. The more knowledge he has of farming methods the more these

vacations will mean. It is not necessary, and perhaps not even important, that the child be taught these things with the idea of making him a farmer, but merely as a means of education and of interest to him in the out-of-doors. The day is coming when agriculture—under other names, perhaps, and not as a professional subject—will be taught in public schools as a "culture study."

There must be a greater interest in parks and public gardens. These institutions have now come to be a part of our civic life. They no longer need apology. We build parks in the same spirit that we build good streets and make sanitary improvements; but the park should be more than a mere display of gardening. It should have an intimate relation with the lives of the people. The greater the number of parks the better for the children. All parks should be open to nature-study teachers, at least on certain days. There should also be children's days in the parks. In some places the park can grow specimens for the school. In large cities it might be a good plan to have some of the common vegetables and farm crops growing in small areas at one side of the park. The tendency, perhaps, is to make our parks too exotic, and to give relatively too much attention to mere roads, statuary and architecture. The perfect garden, from the gardener's point of view, may not be the most useful one. The garden should be so common and so easy to make as to become a part of the child-life.

Some of the specific ways in which our outlook has been extended by the growth of horticulture — which is the growing of plants — may be mentioned:

It has opened our eyes to all the multitude of flowers and ornamental plants.

It has increased our national wealth and has opened the way for large commercial industries.

It has elevated the public taste so that parks and well-kept lawns are now a civic necessity.

It has had much to do with the breadth and spirit of the modern movement that we call nature-study.

It has made plants a part of the home, as books and pictures are. Plant collections stand for culture. Not only do they appeal to the individual who has them, but also to a wide circle of persons, since they are living, growing things and cannot well be hidden.

It has awakened an intrinsic interest in natural objects. People have come to love plants. They like the plant itself as well as its flowers. They know that a plant is worth growing merely because it is a plant. They have come to feel that every animal and plant lives its own life. It has its battles to fight. It contends. Thereby is the individual man carried beyond himself.

VII

THE AGRICULTURAL PHASE OF NATURE-STUDY

The nature-study idea is fundamental to the evolution of popular education. Therefore it may be applied—in fact, must be applied—to all branches of education. It is bound to have a tremendous influence in carrying a vital educational impulse to farmers. The accustomed methods of education are less applicable to farmers than to any other people, and yet the farmers are nearly half our population. The greatest of the unsolved problems of education is how to reach the farmer. He must be reached on his own ground. The methods and the results must suit his needs. The ultimate test of good extension work will be its ability to reach into the remotest districts.

We have failed to reach the farmer effectively because we still persist in employing old-time and academic methods. Historically, the elementary public school is a product of the university and college. "The greatest achievement of modern education," writes W. H. Payne, "is the gradation and correlation of schools, whereby the ladder of learning is let down from the university to secondary schools, and from these to the schools of the people." This origin of "the schools of

the people" from the university explains why it is that these schools are so unrelated to the life of the pupil, and so unreal; they are exotic and unnatural. If any man were to find himself in a county wholly devoid of schools and were to be set the task of originating and organizing a school system, he would almost unconsciously introduce some subjects that would be related to the habits of the people and to the welfare of the community. Being freed from traditions, he would teach something of the plants and animals and fields and people. Yet, as a matter of fact, what do our rural schools teach?

So long have we taught the text-book routine that we do not seem to think that there may be other and better means. I believe in the Greek idea of education for culture, but I would have other education along with it. I believe that it is possible to acquire culture at the same time that we acquire power. Education for culture alone tends to isolate the individual; education for sympathy with one's environment tends to make the individual an integral part of the activities and progress of its time. At all events, I cannot see why there is not as great possibility for culture in the nature-studies as there is in the customary subjects of the elementary school. My plea is that new educational methods must be employed before we can really reach the farming communities. Nature-study is to supply some of these new means. Nature-study must be made a part of the extension-teaching of the time—of that move-

ment which takes the school to the people when the people will not go to the school. The educational impulse must be taken to every man's door. If he shuts the door, it must be thrown in at the window.

All agricultural educational work is yet in an experimental stage in this country, with the single exception of college work—and even this is likely to be much modified within the next few years. Therefore, there are no perfect or generally accepted methods of nature-study as applied to rural education; but sufficient experience has now accumulated to enable any good teacher to make a beginning anywhere with full assurance of doing useful and lasting work. The direct application of nature-study to agricultural education appears to have been started by the Agricultural College of Cornell University. This was in 1895 and 1896. This work is of a true extension character, being conducted from the university as a center, by means of lectures, publications, correspondence, and the organizing of pupils into clubs. It is advisory and propagandic. Its object is to interest teachers and pupils of the public schools in nature-study work with special reference to the agricultural conditions. The first necessity in the work proved to be the need of instruction for the teacher; and to meet this necessity special literature was prepared in the form of "nature-study leaflets." These are designed to inspire the teacher, to give him point of view, to send him directly to nature

to verify the facts and to extend his knowledge, to suggest methods of teaching the subjects. They are not texts from which recitations are to be made. Merely as an example of one set of ideals and one method of improving the agricultural status, a brief outline of this work may be given. The following extract is from a sketch which I contributed to the Sixth Report of Extension Work (Bulletin 206, Cornell Experiment Station, October, 1902):

"To create a larger public sentiment in favor of agriculture, to increase the farmer's respect for his own business—these are the controlling purposes in the general movement that we are carrying forward under the title of nature-study. It is not by teaching agriculture directly that this movement can be started. The common schools in New York will not teach agriculture to any extent for the present, and the movement, if it is to arouse a public sentiment, must reach beyond the actual farmers themselves. The agricultural status is much more than an affair of mere farming. The first undertaking, as we conceive the problem, is to awaken an interest in the things with which the farmer lives and has to do, for a man is happy only when he is in sympathy with his environment. To teach observation of common things, therefore, has been the fundamental means. A name for the movement was necessary. We did not wish to invent a new name or phrase, as it would require too much effort in explanation. Therefore, we chose the

current and significant phrase 'nature-study,' which, while it covers many methods and practices, stands everywhere for the opening of the mind directly to the common phenomena of nature.

"We have not tried to develop a system of nature-study nor to make a contribution to the pedagogics of the subject. We have merely endeavored, as best we could, to reach a certain specific result—the enlarging of the agricultural horizon. We have had no pedagogic theories, or, if we have, they have been modified or upset by the actual conditions that have presented themselves. Neither do we contend that our own methods and means have always been the best. We are learning. Yet we are sure that the general results justify all the effort. In fact, we never believed so fully in the efficiency of this kind of effort as at the present time.

"Theoretical pedagogic ideals can be applied by the good teacher who comes into personal relations with the children, and they are almost certain to work out well. They cannot always be applied, however, with persons who are to be reached by means of correspondence and in a great variety of conditions, and particularly when many of the subjects lie outside the customary work of the schools.

"Likewise, the subjects selected for our nature-study work must be governed by conditions and not wholly by ideals. We are sometimes asked why we do not take up more distinctly agri-

cultural or economic topics. The answer is that we take subjects that teachers will use. We should like, for example, to give more attention to insect subjects, but it is difficult to induce teachers to work with them. If distinctly agricultural topics alone were used, the movement would have very little following and influence. Moreover, it is not our purpose to teach technical agriculture in the common schools, but to inculcate the habit of observing, to suggest work that has distinct application to the conditions in which the child lives, to inspire enthusiasm for country life, to aid in home-making, and to encourage a general movement toward the soil. These matters cannot be forced. In every effort by every member of the extension staff, the betterment of agricultural conditions has been the guiding impulse, however remote from that purpose it may have seemed to the casual observer.

"We have found by long experience that it is unwise to give too much condensed subject-matter. The individual teacher can give subject-matter in detail because personal knowledge and enthusiasm can be applied. But in general correspondence and propagandist work this cannot be done. With the Junior Naturalists, for example, the first impulse is to inspire enthusiasm for some bit of work which we hope to take up. This enthusiasm is awakened largely by the organization of clubs and by the personal correspondence that is conducted between the Bureau and these clubs and their members. It is the desire, however,

to follow up this general movement with instruction in definite subject-matter with the teacher. Therefore, about a year ago a course in Home Nature-study was formally established under the general direction of Mrs. Mary Rogers Miller. It was designed to carry on the experiment for one year, in order to determine whether such a course would be productive of good results, and to discover the best means of prosecuting it. These experimental results have been gratifying. Nearly 2,000 New York teachers are now regularly enrolled in the Course, the larger part of whom are outside the metropolitan and distinctly urban conditions. Every effort is made to reach the rural teacher. Plans are now making for the modification of this Course, by means of which it is hoped that the number of teachers receiving definite correspondence instruction will be very largely increased. [The number has now reached nearly 3,000, February 28, 1903.]

"In order that the work may reach the children it must be greatly popularized and the children must be met on their own ground. The complete or ideal leaflet may have little influence. For example, I prepared a leaflet on 'A Children's Garden' which several people were kind enough to praise. However, very little direct result was secured from the use of this leaflet until 'Uncle John' began to popularize it and to make appeals to teachers and children by means of personal talks, letters and circulars. So far as possible the appeal to children was made in

their own phrase. The movement for the children's garden has now taken definite shape, and the result is that more than 26,000 children in New York State were raising plants during the present year. Another illustration of this kind may be taken from the effort to improve the rural school-grounds. I wrote a bulletin on 'The Improvement of Rural School-Grounds,' but the tangible results were very few. Now, however, through the work of 'Uncle John' with the teachers and the children a distinct movement has begun for the cleaning and improving of the school-grounds of the State. This movement is yet in its infancy, but more than 400 school-yards are now in process of renovation, largely through the efforts of the children.

"The idea of organizing children into clubs for the study of plants and animals and other outdoor subjects, originated, so far as our work is concerned, with Mr. John W. Spencer, himself an actual and practical farmer. His character as 'Uncle John' has done much to supply the personality that ordinarily is lacking in correspondence work, and an amount of interest and enthusiasm has been developed amongst the children which is surprising to those who have not watched its progress.

"The problems connected with the rural schools are probably the most difficult questions to solve in the whole field of education. We believe that the solution, however, cannot begin directly

with the rural schools themselves. It must begin in educational centers and gradually spread to the country districts. We are making constant efforts to reach the rural schools themselves, and expect to exhaust every means within our power, but it is work that is attended with many inherent difficulties. We sometimes feel that the agricultural status can best be reached through the hamlet, village and some of the city schools rather than by means of the red schoolhouse on the corner. By appealing to the school commissioners in the rural districts, by work through teachers' institutes, through farmers' clubs, granges and other means we believe that we are reaching farther and farther into the very agricultural regions. It is difficult to get consideration for purely agricultural subjects in the rural schools themselves. Often the school does not have facilities for teaching such subjects, the teachers often are employed only for a few months, and there is frequently a sentiment against innovation. It has been said that one reason why agricultural subjects are taught less in the rural schools of America than in those of some parts of Europe is because of the few male teachers and the absence of school-gardens.

"This Cornell nature-study movement is one small part of a general awakening in educational circles looking toward bringing the child into actual contact and sympathy with the objects with which he has to do. This work is taking on many phases. One aspect of it is its relation to

the teaching of agriculture and to the love of country life. This aspect is yet in its early experimental stage. The time will come when some institution in every State will carry on work along this line. It will be several years yet before this type of work will have reached what may be considered an established condition or before even a satisfactory body of experience shall have been attained. Out of the varied and sometimes conflicting methods and aims that are now before the public there will develop in time an institution-movement of extension agriculture teaching."

A nature-study movement alone is not sufficient to awaken and reconstruct all the agricultural interests. There should be coordinate efforts outside the schools. In order merely to suggest other lines of effort—and not to commend any particular movement—the following classification of the Cornell extension work may be made: This extension activity in agriculture is regularly and systematically reaching about 75,000 people in that State. Indirectly the work spreads to far greater numbers. Several causes have combined to produce this result, four of which are paramount. (1) The people are ready for the work: they want to learn. (2) Certain persons are ready to do the work: they want to teach. (3) The persons into whose hands the work has fallen are given freedom and autonomy: they are not restricted or hampered by those in authority. (4) The State appropriates money: the appropriation is made because work is done.

Of these four factors, the money is the least. No institution is so poor that something cannot be done if only the first three requisites are present. Time by time, perhaps little by little, the money will come. The work must be born, grow and mature. Only flies and their like are born full size.

Any good extension work is only a diligent effort to meet the needs of the people. If conditions seem to demand a certain kind of effort, that effort is made. No theory of pedagogics is concerned in it. Years hence, perhaps, it will be possible to found a theory on what shall have been accomplished.

From small beginnings the work has grown year by year. This is the most important fact in the entire movement. The work has entered fields that at first were not in sight. It has demonstrated the value of various kinds of effort, and has dropped those which seem to be of least efficiency. The Cornell extension work, as it is being prosecuted to-day [1902], may be displayed as follows:

1. Extension Teaching: Endeavoring to give a new point of view and a quickened enthusiasm to those who live in the country.

(*a*) *Nature-Study:* Teaching the youth to see and to appreciate whatever is nearest at hand, thereby bringing him into sympathy with the conditions in which he lives. This work is prosecuted by several means:

1. By reaching the rising generation. The school children in the grades are organized into Junior Naturalist Clubs to the end that they may love the country better and be content to live therein. Each club receives an embellished charter. Many thousand children are organized each year. For these children a "Junior Naturalist Monthly" is published suggesting topics for observation and study. Each child pays monthly "dues" by writing a letter or essay on some object that it has observed. The dues may be the composition required by the teacher, and it is sent to the nature-study office as it was written, without correction. Having paid its dues, the child receives a badge-button. The Junior Naturalist Club is organized under the general supervision of the teacher, but the detail of the work is carried by the Nature-study Bureau, thereby relieving the teacher of extra responsibilities. In fact, the enthusiasm and centralized interest which the Club introduces into the school lighten the burdens of the teacher.

Connected with the Junior Naturalist enterprise is a Junior Gardener movement, to encourage specifically the growing of plants and the making of gardens. This movement is also promulgated through the schools. It now has attained great headway.

Not only is it educational wisdom to begin work with the children, but it is also one of the most efficient means of getting work done. If the children are once thoroughly interested in any

enterprise, the enterprise will "go." The busiest and most obdurate man will listen to a child; so will parents. If you want to start a nature-study movement or to improve the school premises, arouse the children first.

2. By reaching the teacher directly for the purpose of reaching the pupil. For the teacher "Nature-study Leaflets" have been prepared, giving in each issue a suggestive presentation of some nature-study topic, together with notes of help and suggestion. For those teachers who desire to pursue the subjects further, a home reading course is organized and a "Home Nature-study Lesson" is published.

3. By interesting the teaching fraternity in general, through lectures at teachers' institutes and conventions, attendance on particular schools where work is being done, and other personal work. A lecturer is employed to attend State teachers' institutes, occupying a regular period on the program; this work is possible through the cooperation of the State Department of Public Instruction.

4. By summer-school teaching in the teachers' schools conducted by the State Department of Public Instruction. For two years a special nature-study summer-school was held at Cornell University, but being obliged to husband the resources this enterprise was reluctantly dropped.

5. By nature-study instruction in the University, given to those teachers who desire it.

6. By interesting the public in plant-growing,

particularly in the improvement of school-grounds and the planting of gardens.

7. By direct personal correspondence with parents, teachers, ministers and other interested parties.

(*b*) *A Farmers' Reading-Course;* inducing actual farmers to pursue definite courses of reading in the winter season. The farmer who desires to read books will help himself. In this work, the effort is made to gain the attention of those who do not read books. The literature is furnished by the University, being written by members of the Extension Staff. This literature is in the form of easy eight-page "Reading-Lessons," detailing principles. Each lesson is accompanied by a set of questions, the answers of which are sent to the Bureau, entitling the reader to remain on the rolls. The Reading-Lessons are in three series of five each, as follows:

First-year series, on soil and plant-food.

Second-year series, on stock-feeding and dairying.

Third-year series, on fruit-growing.

Each reader takes these series in course. If any one desires to continue his reading beyond the third year, he is recommended to books.

The readers are aided in the formation of Reading-Clubs, to meet twice each month for the five winter months, thereby devoting two discussions to each lesson. Inspectors and lecturers visit the clubs.

The Reading-Club may arrange for experiments on local agricultural difficulties, to be conducted

during the summer. This may be expected to maintain the interest throughout the busy season.

The culmination of the Reading-Course is an eleven weeks' term of instruction at the University in the winter, to which readers and others are eligible.

Reading-Course and text-book work must not be confounded with true nature-study work. The former aims directly at the imparting of information; the latter seeks to put one in sympathy with his surroundings. Any successful reading-course work brings the reader into sympathy with nature, but that is not its prime motive. The nature-study bulletin is distinct from the agriculture or farming bulletin, however elementary the latter may be.

Coordinate with the regular farmers' Reading-Course, there is a course for farmers' wives. The most difficult and discouraging feature of American agriculture is the isolated position of the farmer's wife. This position can be alleviated only by the elevation of the general tone of farm life. The farmers' wives' course is modeled after that for farmers, but it has its own literature. The publications of the Farmers' Wives' Reading-Course are thus far as follows:

Saving Steps,
Home Sanitation,
Saving Strength,
Food for the Farmer's Family,
The Kitchen Garden,

Practical Farm Housekeeping (two lessons),
Reading in the Farm Home.

[Those who desire a history of the farmers' reading-course movement should consult Bull. 72, Office of Experiment Stations, U. S. Department of Agriculture.]

2. ITINERANT EXPERIMENTING: Endeavoring to solve local agricultural perplexities by experiments on the spot, and also to illustrate the application of well-known knowledge. These experiments are of many kinds, conducted in many places. This is necessarily so, because the difficulties of farmers are so many and various. Certain definite series of illustrative experiments, have been planned from the central station, however, and farmers have been asked to cooperate. Chief of these are experiments with fertilizers, sugar beets, spraying orchards, potato and bean culture, cover-cropping, alfalfa-growing, poultry-raising. Experts are sent to investigate outbreaks of insects, fungous attacks on plants, diseases of stock, and other special difficulties. Experiments on various problems intimately associated with the extension work are also made at the University itself. Much of the results of the experimental work connected with the extension enterprise has appeared in bulletins; but its chief value is not in its publication, but in its educational effect in the communities in which it is conducted.

All this looks large and complete when seen in type, but it is the merest beginning of what should

be and can be done. Other lines of effort must be added. In many places similar work is in progress. The great agricultural States of the middle West promise to become leaders. The efficiency of the work will depend in large measure on its adaptability to the particular conditions and people to be served.

The ideals of nature-study are everywhere the same; but the methods and means are capable of endless modification. There is always danger that too much emphasis will be placed on mere "learning" on the part of the child or the pupil. The real value of the extension work with the young lies in interesting, enthusing, inspiring them. Mere information, however valuable, will not cause a person to be a farmer, nor incline him to live in the country. Of course the work must be practical—that is, it must be truthful, direct, forceful, and must put the child into intimate contact with its own life. It must aim to give him power and enterprise rather than assorted facts—although the facts may be so handled that they become the means and not the end. I fear that some good persons are too insistent on getting "agriculture" into the schools. There is no gain in getting the word into the curriculum unless the subject is really taught with optimism and with purpose.

It is a common desire to bring the rural schools into intimate relations with the life of the community merely by employing teachers having knowledge of farm life. This may be of little

consequence: the first merit of a teacher is to be able to teach, whatever his sympathies or technical knowledge. Many good persons seem to think that the only thing to do to reform any school problem is to get a teacher, forgetting that, in the long run, teachers arise in response to a general demand, or at least must be supported by a public sentiment. It is really beginning with the wrong end of the problem merely to ask for teachers having knowledge of agriculture. We should first awaken a general desire on the part of patrons for the new type of instruction: when this desire is aroused, the teachers will be found. Usually more can be done by beginning with the children rather than with the teacher. The children can be aroused by some outside agency. This is the meaning of the Junior Naturalist movement in New York State. Probably the true way to bring the rural school into intimate touch with rural affairs is to begin both with patrons and teachers, placing far the greater dependence on the work with patrons—and with the patrons the best results are to be expected from work with the children. By interesting the parents we shall bring pressure to bear on local school boards, school commissioners and superintendents, and school teachers to provide more usable and direct instruction.

Children are always ready to "do something." The success of kindergarten and school-garden work rests on this common trait. The school-garden idea can be variously modified. A recent

adaptation of it is the "district school experiment garden" projected by O. J. Kern, Superintendent of Schools of Winnebago County, Illinois. These Illinois gardens are designed for the explicit teaching of agricultural subjects. Is it not strange that schools in farming communities should not be equipped with a bit of farmed land? Aside from the tilled school-garden, why not make arrangement with the adjoining farmer to pasture his stock next the school-ground now and then? And why not have this farmer give the children talks about the animals?

In recent years there has been a marvelous application of knowledge and research to agricultural practice. We have exerted every effort to increase the productiveness and efficiency of the farm, and we have entered a new era in farming—a fact that will be more apparent in the years to come than it is now. The burden of the new agricultural teaching has been largely the augmentation of material wealth. Hand in hand with this new teaching, however, should go an awakening in the less tangible but equally powerful things of the spirit. More attractive and more comfortable farm homes, better reading, more responsive interest in the events of the world, closer touch with the common objects about him—these must be looked to before agriculture really can be revived. Appeal to greater efficiency of the farm alone cannot permanently relieve the agricultural status. This is all well illustrated in the attitude of children toward the

farm. In a certain rural school in New York State of say forty-five pupils, I asked all those children that lived on farms to raise their hands: all hands but one went up. I then asked all those who wanted to live on the farm to raise their hands: only that one hand went up! Now, these children were too young to feel the appeal of more bushels of potatoes or more pounds of wool, yet they had this early formed their dislike of the farm. Some of this dislike is probably only an ill-defined desire for a mere change, such as one finds in all occupations, but I am convinced that the larger part of it was a genuine dissatisfaction with farm life. These children felt that their lot was less attractive than that of other children; I concluded that a flower garden and a pleasant yard would do more to content them with living on the farm than ten more bushels of wheat to the acre. Of course, it is the greater and better yield that will enable the farmer to supply these amenities; but at the same time it must be remembered that the increased yield itself does not awaken a desire for them. I should make farm life interesting before I make it profitable.

These points of view are well expressed by David Felmley, President of the Illinois State Normal School, at Normal: "It is evident that the argicultural experiment station will never accomplish its purpose unless there is diffused among our farming population an elementary knowledge of the sciences relating to agriculture. The rural schools and the high schools attended

by farmers' sons must provide the necessary instruction. There seems no other practical way. The special instruction offered in this line is not merely to train skilful farmers. It is quite important that farmer boys and girls learn to appreciate and love the country. There need be here no division in material or method. The knowledge of soil and atmosphere, of plant and animal life that makes him an intelligent producer, puts him in sympathetic touch with these activities of nature. If the farmer as he trudges down the corn rows under the June sun sees only clods, and weeds, and corn, he leads an empty and a barren life. But if he knows of the work of the moisture in air and soil, of the use of air to root and leaf, of the mysterious chemistry of the sunbeam, of the vital forces in the growing plant, of the bacteria in the soil liberating its elements of fertility; if he sees the relation of all these natural forces to his own work; if he can follow his crop to the market, to foreign lands, to the mill, to the oven and the table; if he knows of the hundreds of commercial products obtained from his corn or the animals that it fattens: he then realizes that he is no mere toiler; he is marshaling the hosts of the universe, and upon the skill of his generalship depends the life of nations."

It will be seen at once that all these new ideals are bound to result in a complete revolution of our current methods of rural school-teaching. The time cannot be very far distant when we

shall have systems of common schools that are built upon the fundamental idea of serving the people in the very lives that the people are to lead. In many places there are strong protests against the old order; in other places there are distinct beginnings of the new order. The following protest is by John J. McMahan, State Superintendent of Education for South Carolina: "The old-time high school prepares for the exceptional life. There is little room for Latin and Greek and fancy learning in the system of education that looks to the future lives of the great body of breadwinners and home-builders. We must abandon the pleasing delusion that all go to school with expectation of afterward going to college. We know that hardly one in a hundred will ever go to college. We define education as a preparation for complete living. Have we not adapted our preparation to the unusual and improbable life, and largely neglected preparing the average man for the duties almost certain to be upon him? We should recognize that complete living is a relative term, and that the complete life which is the ideal of the philosopher, and of the statesman as well, is not the complete life that can be realized at this stage of human development by any great number of our citizens. In holding up a high standard of education as the ultimate right of every citizen, let us not be so unmindful of the present as to deny to nearly all that education which could be given them to their great benefit and happiness."

The beginnings of the new order are seen in the nature-study movement, the establishing of agricultural high schools, the strong agitation for country or district industrial schools, the spread of reading-courses, the rise of pupils' gardens, the general awakening of rural communities. Books and methods are now made for town schools rather than for country schools; the real texts for the rural schools are just now beginning to appear, and they represent a new type of school literature. In the future, the text-book is to have relatively less influence than in the past. We have been living in a text-book and museun age. All this old method is not to be complained of. The fact that so many new subjects and propaganda are coming in shows that we are in the midst of an evolution: we are in the making of progress.

This new teaching for the farmer is a most attractive field for well-directed effort. We need more teachers for it in the colleges and normal schools and common schools. The teaching in our agricultural colleges should be seized with the missionary spirit, with the desire to send out young persons who care not so much to make professors and experimenters in the great institutions, as to give themselves to spread the gospel of nature-love and of self-respecting resourceful farming through all the colleges and all the public schools. The time is coming quickly when the college or school that wants really to reach the people must teach rural subjects from the human point of view.

The real solution of the agricultural problem—which is at the same time the national problem—is to give the countryman a vital, intellectual, sympathetic, optimistic interest in his daily life. For myself, if I have any gifts, I mean to use them for the spiritualizing of agriculture.

We are on the borderland of a mighty country: we are waiting for a leader to take us to its center.

VIII

REVIEW

In the increasing complexities of our lives we need nothing so much as simplicity and repose. In city or country or on the sea, nature is the surrounding condition. It is the universal environment. Since we cannot escape this condition, it were better that we have no desire to escape. It were better that we know the things, small and great, which make up this environment, and that we live with them in harmony, for all things are of kin; then shall we love and be content.

All men love nature if they but knew it. The methods and fashions of our living obscure the universal passion. The more perfect the machinery of our lives the more artificial do they become. Teaching is ever more methodical and complex. The pupil is impressed with the vastness of knowledge and the importance of research. This is well; but at some point in the school-life there should be the opening of the understanding to the simple wisdom of the fields. One's happiness depends less on what he knows than on what he feels.

There are men and women who pursue science for science's sake without thought of its relation to human lives. They are the explorers of the

intellectual sphere. Immensely do they extend our horizon. They add to the store of subject-matter. They make progress possible. But these persons must always be the few. They are a professional class. Most persons desire those things which have relation to the ideals of living. To them, science as science is of little moment. They cannot pursue it. It is dry. But it may be made a means of giving them closer touch with nature. If pursued too far or in too great detail, it may repel rather than attract. What we teach as science drives many a person from nature. We must reach the people; but we can reach them only by looking from their point of view. Most persons cannot be investigators. In the school-life there must come a reaction from the too exclusive view-point of science.

In the early years we are not to teach nature as science, we are not to teach it primarily for method or for drill: we are to teach it for living and for loving—and this is nature-study. On these points I make no compromise.

The best living must always be a striving for ideals. The day of the idealist is not passed. It is here. We must not allow the phenomenal development of our material progress to obscure it. We must rise to higher ideals. We must educate the child for the life of the next generation. A good teacher has the gift of prophecy. The twentieth century is coming in with a spiritual awakening. One sign of this awakening is the

outlook nature-ward. The growing passion for country life is a soul-movement.

More and more, in this time of books and reviews, do we need to take care that we think our own thoughts. We need to read less and to think more. We need personal, original contact with objects and events. We need to be self-poised, self-reliant. The strong man entertains himself with his own thoughts. No person should rely solely on another person for his happiness.

The power that moves the world is the power of the teacher.

PART II

I

THE INTERPRETATION OF NATURE

I ONCE saw two sisters standing on the doorstep bidding good-by to their husbands, who were off for a day's outing. One looked at the sky and said: "I am afraid it will rain." The other looked at the sky and said: "I know that you'll have a good time." There was one sky, but there were two women. There were two types of mind. There were two outlooks on the world. There were two points of view.

The greatest thing in life is the point of view. It determines the current of our lives.

The satisfaction that we derive from the external world is determined by the attitude in which we consider it. All unconsciously one's habit of mind toward the nature-world is formed. We grow into our opinions and beliefs without knowing why. It is therefore well to challenge these opinions now and then, to see that they contain the minimum of error and misdirection. This challenging of the point of view is the theme of the text that I am writing.

Nature-study, properly handled, interprets nature. It does not stop dead with the information that is acquired. It endeavors to understand as well as to see.

II

SCIENCE FOR SCIENCE'S SAKE

THE other day I attended a teachers' convention. A demure little woman told of the enthusiasm with which her pupils collected butterflies and plants, and she described the museum that they had made. She showed a folio of mounted plants, and a cigar-box containing insects. I admired the specimens, and mentally I complimented her judgment in finding so good use for such a box. The tobacco odor kept the carnivorous bugs away, and I also commended the judgment of the bugs. There was genuine enthusiasm in the little woman's manner, and I wanted to be a young naturalist. When she was talking, I strayed far in the fields and picked a dandelion.

But there was a man in the audience who squelched the little woman. Her methods were all wrong. They were worse than wrong: the children must unlearn what she had taught them. She should have begun with some definite subject, and followed it systematically and logically. The pupil must be held to the task day after day, until he masters the topic. To skip from subject to subject is to be superficial. This way of teaching does not result in mental drill. To make a collection is only play, and names are vulgar. The pupil

must be impressed with the immensity and importance of his subject. When he was talking, I smelled alcohol and I saw a frog in a museum jar.

Which was right? No doubt each was correct from the personal point of view, but wrong from the other's point of view. I recalled that the little woman only recited what she had done; the man upbraided her for not doing something else. Perhaps it is easy to advise and to criticize. The little woman was teaching children. She wanted to lead them to love the things they saw. She approached the subject from the human side, for are not the boy and the girl a part of what we call nature? They are not yet tamed and conventionalized. Does not every boy and girl like to go in the fields and "get" things? She was not thinking of the subject-matter; or if she did think of it, she knew that it could take care of itself. All she was thinking of — poor soul! — was to interest and educate the children. And she knew that if she set a subject and followed it day by day the seats would soon be vacant.

The man was thinking of his college students; perhaps he had not considered that these students already liked the subject and needed only instruction. He forgot that you cannot force a person to choose a thing, although you may force him to take it. His were picked students, one from this town and another from that; hers were all the pupils in her little community. His pupils had seen and had chosen; to hers the world was all unseen and untried. His were the one in a hundred; hers

were the entire hundred. His students had elected the subject; for this subject they were to live; they would increase the boundaries of knowledge; they would be scientists. He did not consider that all pupils would not be scientists.

Sometimes it seems as if scientists think that they have the right of way in the subjects which they espouse; but there is more than one way of interpreting nature. Their view is necessary in all matters of fact and truth, but not when points of view are concerned. This is well illustrated in the usurpation of common words. The word "organic" relates to organisms and their products. But when the chemist studies the composition of organic compounds he defines the word in terms of chemistry. To him an organic compound may be a carbon compound or a carbohydrate derivative; and he can make an organic compound without any relation to an organism! Organic is originally a biological, not a chemical idea. Again, our forefathers used the word "bug" for various kinds of bugs; but scientists have taken this word "bug" and have made it mean only a particular kind of a bug. This is all well enough amongst themselves, but when they attempt to make all the rest of the world use "bug" as they do they go too far. Our forefathers have prior claims. It would be better if newly made words could be used for new ideas. Science needs a technical language of its own.

What is the kernel of all this discussion about the pedagogical sin of making collections and of

attaching names thereto? The old idea of the study of nature was to make an inventory of things. The objects are bewilderingly numerous, and to put them away in a cabinet, with a proper ticket attached, was to know them. The great want was names and classification; and these names must be arranged in books. This natural history bookkeeping received its largest impetus from the binomial method of naming, which might be called a system of "double entry."

This naming of objects is necessary. It is the starting-point, as a city directory is. But it is only the beginning of wisdom. It is not an end. The profound speculations of the modern evolutionists have emphasized the importance of the things themselves, and particularly of real or live things. The point of view has changed. Do not let your pupils make an herbarium, the modern teacher will say, but tell them to study the plants. We all sympathize with this point of view; but what are we going to do with this native and exuberant desire of the child to explore and to collect? We are taught, also, that we should develop and strengthen the natural powers. One of my friends will not let his little boy make an herbarium, because that is mere superficial amusement; so the child collects postage stamps. He does not care to have him know the names of plants, but he is very careful to have him properly introduced to visitors; and what is an introduction but a conventional passing of names?

I believe that we have gone too far in decrying

the making of collections. We can make the collecting the means of securing real information. We can fasten the attention of the child. The one caution is, not to make it an end. The child cannot collect without seeing the object as it lives and grows. It appeals to him more in the field than it does in the museum. Let him collect for the purpose of understanding a problem. Where does the dandelion grow? What are the plants in yonder bog? How many are the weeds in the orchard? What are the borers in the old log? Set the child a field problem and he will collect in spite of himself. Then the collecting has teaching power. But to make a collection of one hundred specimens in order to obtain a pass-mark is scarcely worth the effort. The point I wish to urge is that there is no reason in the nature of things why subjects always should be taught this way or that, so long as they are taught truthfully — and there are many ways of teaching the truth. The way to teach is, after all, mostly a matter of experience and expediency. Things were not made either to be analyzed or collected.

III

THE EXTRINSIC AND INTRINSIC VIEWS OF NATURE

"THE purpose of this exercise is to tell children how to see the hidden beauties of flowers." Thus ran the announcement at the opening of the classroom period. Is it worth while to tell them any such thing? Why not teach them to be interested in plants? Why give them a half-truth when they might have the whole truth?

The "beauty" of a flower or a bird is only an incident: the plant or the bird is the important thing to know. Beauty is not an end. The person who starts out to see beauty in plants is often in the condition of mind that the dear old lady was who came into my conservatory and exclaimed, as she saw the geraniums, "Oh, they are as pretty as artificial flowers!"

~~But these~~ Some people are not looking for beauty, ~~after all~~; they look for mere satisfying form or color or oddity. They confound beauty with prettiness or with outward attractiveness. Real beauty is deeper than sensation. It inheres in fitness of means to end as well as in physical attributes. The child should see the object itself before he sees its parts. Teach first the whole bug, the whole bird, the whole plant. The botanist may

well devote his life to a single cell, but the layman wants to know the trees and the woods.

I dislike to hear people say that they love flowers. They should love plants; then they have a deeper hold on nature. Intellectual interest should go deeper than mere shape or color. Teachers or parents ask the child to see how "pretty" the object is; but in most cases the child wants to know how it lives and what it does.

It is instructive to note the increasing love for wild animals and plants as a country grows old and mature. This is particularly well illustrated in plants. In pioneer times there are too many plants. The effort is to get rid of them. The forest is razed and the roadsides are cleaned. The pioneer is satisfied with things in the gross. If he plants at all, he usually plants things exotic or strange to the neighborhood. The woman grows a geranium or fuchsia in a tin can, and now and then makes a flower-bed in the front yard; but the man is likely to think such things beneath him. If a man has flowers at all, he must have something that will fill the eye. Sunflowers are satisfying.

But the second and third generations begin to plant forests and to allow the roadsides to grow wild at intervals. Persons come to be satisfied with their common surroundings and to derive less pleasure from objects merely because they are unlike their surroundings. Choice plants come into the yards here and there, and the men of the household begin to care for them. The birds and wild animals are

cherished. Love of books increases. All this marks the growth of the intellectual life.

America is a land of cut flowers. Nowhere does the cut-flower trade assume such commanding importance. Churches and homes are decorated with them. One sees the churches of the Old World decorated with plants in pots or tubs. The Englishman or the German loves to care for the plant from the time it sprouts until it dies: it is a companion. The American snips off its head and puts it in his buttonhole: it is an ornament. I have sometimes wondered whether the average flower-buyer knows that flowers grow on plants. Flowers are fleeting.

All of us have known people who derive more satisfaction from a poor plant that never blooms than others do from a bunch of American Beauty roses at $5. There is individuality — I had almost said personality — in a growing, living plant, but there is little of it about a detached flower. And it does not matter so much if the plant is poor and weakly and scrawny. Do we not love poor and crippled and crooked people? A plant in the room on washday is worth more than a bunch of flowers on Sunday.

But the American taste is rapidly changing. Each year the florist's trade sees a proportionately greater demand for plants. The same change is seen in the parks and home grounds. More and more the gross carpet-beds are relegated to those parts of the grounds that are devoted to curiosities, or they are omitted altogether, and in their

stead are restful sward and peaceful verdure. Flowers are not to be despised, but they are accessories.

This habit of looking first at what we call the beauty of objects is closely associated with the old conceit that everything is made to please man: man is only demanding his own. It is true that everything is man's because he may use it or enjoy it, but not because it was designed and "made" for "him" in the beginning. This notion that all things were made for man's special pleasure is colossal self-assurance. It has none of the humility of the psalmist, who exclaimed, "What is man, that thou art mindful of him?"

"What were these things made for, then?" asked my friend. Just for themselves! Each thing lives for itself and its kind, and to live is worth the effort of living for man or bug. But there are more homely reasons for believing that things were not made for man alone. There was logic in the farmer's retort to the good man who told him that roses were made to make man happy. "No, they wa'n't," said the farmer, "or they wouldn't 'a' had prickers."

Being human, we interpret nature in human terms. Much of our interpretation of nature is really an interpretation of ourselves. Because a condition or a motive obtains in human affairs, we assume that it obtains everywhere. The only point of view is our own point of view. Of necessity, we assume a starting-point; therefrom we evolve an hypothesis which may be either truth or fallacy.

Asa Gray combated Agassiz's hypothesis that species were originally created where we now find them and in approximately the same numbers by invoking Maupertuis's "principle of least action"—"that it is inconsistent with our idea of divine wisdom that the Creator should use more power than was necessary to accomplish a given end." The result may be secured with a less expenditure of energy than Agassiz's method would entail. But who knows that "our idea of the divine wisdom" is truthful? It is only a human metaphor; but, being human, it is useful.

Much of our thinking about nature is only the working out of propositions in logic, and logic is sometimes, I fear, but a substitute for fact. It is impossible to put ourselves in nature's place — if I may be allowed the personification; that is, difficult to get the point of view of the organism that we are studying. If it were possible to get that point of view, it would be an end to much of our speculation; we should then deal with fact.

We hope that we are coming nearer to an intrinsic view of animals and plants; yet we are so intent on discovering what ought to be that we forget to accept what is.

IV

MUST A "USE" BE FOUND FOR EVERYTHING?

EACH pupil had a plant of the spring buttercup. The teacher called attention to the long fibrous roots, the parted leaves, the yellow flowers; but these parts were apparently only incidentals, for she touched them lightly. But the hairs on the stem and leaves were important. They must be of some use to the plant. What is it? Evidently to protect the plant from cold, for does not the plant throw up its tiny stem in the very teeth of winter? It was clear enough; and thus are we taught that not the least thing is made in vain. Everything has its place and use; it is our business to determine what the uses are. We must think of these things as we come and go.

I wondered how these children would look upon the plants and animals they meet, and what the great round world would mean to them. The blackberry has thorns to keep away the animals that would harm it; the rabbit has soft short fur that it may not be caught in the briers; the poison sumac has venom to protect it from those who would destroy it; the crow is black that it may not be seen at night; the nettle has stings to punish its enemies; the dog fennel has rank scent to protect

it from the browsing animals. All the world is as perfect as a museum!

I wondered what would happen if some inquisitive child were to ask what becomes of all the plants which have no thorns or hairs or poison or ill scent. What if he should ask why the thornless blackberry does not perish, or why the sumacs that are not poisonous still live, or if he should suggest that the dandelion comes up earlier in the spring than the buttercup and yet has no hairs on its slender flower stem? As I wondered, a little hand went up. The teacher granted a question. "Pigweeds ain't got any prickers," said the boy. I saw that the boy was a philosopher. "True enough," replied the teacher promptly, "but I am sure that it has something with which to protect itself."

Thereby I knew her point of view: she had made up her mind what to see, and it was necessary only to hunt until she saw it; and in this respect she was like many another. Persons seem to interpret the struggle for existence as a fight. It is a sanguinary combat between adults. Everything must protect itself with armor. A botanist, in writing a description of a new and strange plant, noted the peculiar spines and then remarked: "That these are of some use to the plant can hardly be doubted. Perhaps they serve to prevent the access of undesirable insects."

Nothing is easier than to find an explanation for anything; the only difficulty is to determine whether the explanation is true. I have just read in an old book that the reason why a particular kind of graft

failed to grow was because of the "disappointment of the sap." I laughed at the expression; and yet is it not as scientific as to say that the hairs exist to keep the crowfoot warm or that the sumac has poison to protect it from its enemies? The teacher may as well have said that Jimmie Brown has freckles so that the sun will not tan his skin; and the statement would be hard to disprove.

The other day a teacher asked me whether it is not true that the cactus has spines in order to protect it from browsing animals. I told her that I did not know. As I was a stranger to her, she wondered at my ignorance. She wanted to know why I did not know. I told her that I had no good evidence that an animal wanted to browse on a cactus. Perhaps the cactus spines are older than browsing animals. Perhaps there was some special condition or reason in geologic time. Perhaps the spines were in some way the incidental result of the contraction of the plant body, which contraction was associated with the necessity of reducing the evaporating surface in an arid climate. Perhaps a hundred things. She was surprised that I had to go into geologic time to bury my ignorance. She wanted cause and effect side by side and in the present. Then she could see them. It is a bother to look behind for causes.

This is a typical case. This attitude toward nature comes almost daily to the teacher; in fact, it sometimes comes from the teacher. The mischief is increased by many popular books on science, and

some of these books have been written by persons who have done noble work for truth.

This is one of the greatest faults with the popular outlook on nature — the belief that every feature of plant or animal has a distinct use in the present time and that one has only to look to see what that use is. Persons often look at the little things and miss the big ones. They look for the hairs and miss the plant. They see the unusual and rare and overlook the common. I wish that people might learn to see dandelions.

Having seen a thing of which the function is not evident, they assume a condition and jump at a conclusion. A plant has poison ; various creatures eat plants; the creatures are killed by poison: therefore the plant has poison to protect itself from the creatures. Now, it may even be true that the poison does protect the plant, but there is no proof thereby that the poison was produced for that purpose. The physiologist may find that the poison in the given case is merely a waste product of some chemical metabolism, and that the plant is fortunate in getting rid of it. If the plant is now and then protected, the result is only an incident. If it should appear that one kind of plant, by natural selection, has developed poison in order to protect itself, the fact would be spread abroad in book and magazine, but it would not be stated that it was one case out of a thousand. The exception is enlarged into the rule. Persons like to write about perfect adaptation of means to ends, without a slip or break in the process. A teacher brought a flower and

asked what mechanism it had to insure cross-pollination. I told her that I was not aware that it had any; and she was surprised. I wish that somebody would write a book about misfits in nature.

No one knows what spines and thorns are "for," and the true naturalist does not ask the question. He wants to know how they came to be. How did they originate? What is their significance in the development of this particular race? And he sets to work to find out. He cannot find out as he rides by on his horse — especially if he rides a hobby-horse.

Truth is, this everything-has-a-use dogma is in part a reaction from the teachings of Darwin and his followers. People want to believe in definite, final, set events. The dogma of special creation was overthrown. Things have persisted because of natural selection — because they were best fitted to persist. The result, in many cases, is perfect adaptation of every organ and attribute. There followed a special literature on adaptation and mimicry and the like. The examples may all have been true, but one result has been to lead persons to look for adaptations and mimicry where there may be none. What did it matter if there is no special creation? — there is complete and universal adaptation, and our notions of what ought to be are verified.

But, some one will say, if there is natural selection and survival of the fittest, adaptation must follow as a consequence. Yes; but it does not follow that

every part or feature of the organism is specially adapted. A strong feature may carry other features which are merely innocuous or even harmful, as a horse carries a rider; and then, if unfit features tend to pass away, these features are misfits until they have disappeared.

V

THE NEW HUNTING

THE world is full of animals and plants. Every animal and plant has the power to multiply itself many fold. Every one contends for an opportunity to live.

This contention forces the individual to live for itself. Self-preservation, it is said, is the first law of nature. The animal appropriates food, usurps territory, kills and even devours its contestants. It kills because it must. It is goaded by the whip of necessity. To live is the highest desire that it knows. Its acts need no justification.

Man also is an animal. He has come up from the world-fauna. On his way he contended hand to hand with the other animal creation. He killed from necessity of obtaining food. As he arose above his contestants, this necessity became less urgent. He has now obtained dominion, but he is not yet fully emancipated from the necessity of taking life. Perhaps complete emancipation will come.

The old desire to kill — first born of necessity — still lingers. But now we kill also for "sport." Practically a new motive has been born into the world with man — the desire to kill for the sake of killing. One generation of white men is sufficient practically to exterminate the bison and several

other species. All this needs justification. The lower creation is not the plaything of man.

We are still obliged to kill for our necessities. We must secure food and raiment. More and more we are rearing the animals that we would take for food. We give them happier lives. We protect them from the severities of the struggle for existence. We remove them from the necessities of protecting themselves from violence. We take our own. There is no question of morals. We give that we may take; and we take because we must.

To kill for mere sport is a very different matter: it lies outside the realm of struggle for existence. Too often there is not even the justification of fair play. Usually the hunter exposes himself to no danger from the animal that he would kill. He takes no risks. He has the advantage of long-range weapons. There is no combat. Over on the lake shore are great cones of ice, built up by the accretions of the waves. Several stalwart men have skulked behind them and lie secure from observation. A little flock of birds, unsuspecting, unprotected, harming no man, obeying the laws of their kind, skims across the water. The guns discharge. The whole flock falls, the mangled birds struggling and crying, and tainting the water with their blood as they are carried away on the waves, perhaps to die on the shores. There is a shout of victory. Surely, man is the king of beasts!

But there is another and fairer side than this. The lack of feeling for wounded animals is often

thoughtlessness. The satisfaction in hunting is often the joy of skill in marksmanship, the pleasure of woodcraft, the enthusiasm of being out-of-doors, the keen delight in discovering the haunts and ways of the nature-folk. Many a hunter finds more pleasure in all these things than in the game that he bags. The great majority of hunters are gentle and large-hearted men. They are the first to discourage mere wantonness and brutality. Under their hand, certain animals are likely to increase, because they eliminate the rapacious species. To the true sportsman hunting is not synonymous with killing. It is primarily a means of enjoying the free world of the Out-of-doors. This nature-spirit is growing, and there are many ways of knowing the fields and woods. The camera is competing with the trap and gun.

I must not be understood as opposed to hunting with the gun or the rod. Every man has a right to decide these questions for himself. I wish only to suggest that there are other ideals. I wish to point out the tendency to know things as they live and for what they are. There was a time when animals were known mostly in museums, or in books that smelled of museums. We now know them in woods and fields. We know what they do, as well as what they are. Making pictures from stuffed specimens will soon be a thing of the past. Read any book of natural history of fifty years ago; then read one of to-day. Note the road by which we have come: this may color your own attitude toward the nature-world.

A new literature has been born. It is the literature of the Out-of-doors. It is written from the world viewpoint, rather than from the study viewpoint. Man is not the only, nor even the chief, actor. Even the stories of animals of the old time do not have the flavor of this bright new literature. Not so very long ago animal stories were often told for the purpose of carrying a moral — they were self-conscious. Now they are told because they are worth telling. The real moral is the interest in the animal and the way in which it contrives to live, not in some extraneous literary appendage that tries to make an application to human conduct. No longer can one write a good nature-piece until he has intimate knowledge of the animal or plant in the wild, and has tried to put himself in its place. Perhaps the old school of literary effort is not losing ground; but it is certain that the new is gaining. The new literature is founded on specific technical knowledge, but it embraces all the human sympathies. It is the outcome of the study of objects and phenomena. The first product was scientific literature. The second is the lucid resourceful nature-writing of the present day. There are new standards of literary excellence.

The awakening interest in the nature-world is strongly reflected in the game laws — for these laws are only an imperfect expression of the growing desire to let everything live its own life. The recent revulsion of feeling against the shooting of trapped pigeons, as expressed in agitations before

state legislatures, is an excellent example in point. It is gratifying that a prominent place in the discussions for good game laws is taken by sportsmen themselves. It is recognized that hunting for sport must be kept within bounds, and that it must rise above mere slaughter of defenseless animals.

Another expression of this growing sympathy is exhibited in the reservation of certain areas in which animals are to be unmolested. It is a most significant fact that while many country regions are practically shot clean of animal life, sometimes even to songbirds, the parks and other public properties in cities often support this wild life in abundance. Usually it is easier to study squirrels and many kinds of birds in the city parks than in their native wilds. To this awakening interest in the preservation of animals is now added the desire to preserve the wild flowers. The future will see the wild animals and plants safely ensconced in those areas that lie beyond the reach of cultivated fields; and these things will be the heritage of the people, not of the hunter and collector alone.

This desire to protect and preserve our native animals is well expressed in President Roosevelt's reference to the subject when discussing the forest preserves in his first message to Congress: "Certain of the forest reserves should also be made preserves for the wild forest creatures. All of the reserves should be better protected from fires. Many of them need special protection because of the great injury done by live stock, above all by sheep. The increase in deer, elk and other animals in the

Yellowstone Park shows what may be expected when other mountain forests are properly protected by law and properly guarded. Some of those areas have been so denuded of surface vegetation by overgrazing that the ground-breeding birds, including grouse and quail, and many mammals, including deer, have been exterminated or driven away. . . . In cases where natural conditions have been restored for a few years, vegetation has again carpeted the ground, birds and deer are coming back, and hundreds of persons, especially from the immediate neighborhood, come each summer to enjoy the privilege of camping. Some at least of the forest reserves should afford perpetual protection to the native fauna and flora, safe havens of refuge to our rapidly diminishing wild animals of the larger kinds, and free-camping grounds for the ever-increasing numbers of men and women who have learned to find rest, health and recreation in the splendid forests and flower-clad meadows of our mountains. The forest reserves should be set apart forever for the use and benefit of our people as a whole, and not sacrificed to the short-sighted greed of a few."

The enlargement of our sympathies is also well reflected in the many societies that aim to lessen cruelty to animals. This movement is an outgrowth of the rapidly growing feeling of altruism — the interest in others — which, in the religious sphere, has ripened into the missionary spirit and into toleration. The prevention of cruelty to animals is of more consequence to man than to the animals. They suffer less than we. Perhaps the movement

is in danger here and there of degenerating into mere sentimentalism; but, on the whole, it is sane and potent, because it measures our increasing sensitiveness.

Hunting to kill is not necessarily cruel. The best hunting is that which kills quickly. The poorest—for both the hunted and the hunter—is that which prolongs the struggle. The "gamey" fish is the one most liked by anglers. The "sport" of catching him depends on his desperate struggle for life; and this struggle is often prolonged that the excitement may be greater! Nature herself could be indicted for cruelty were not her practices dictated by inevitable conditions; but this fact does not release man, who acts largely as a moral agent. In nature, many animals meet violent or tragic deaths. The bird of passage that cannot keep up with its fellows is caught by the hawk or owl. The weaklings and the stragglers are taken. Raise the curtain of night and behold the tragedies. Where are the graves of the unfit?

The practices of any age are but the expressions of the needs and motives of that age. Much of the hunting is dictated by the desire of profits in money, and these profits often depend on fashion. Mere fashion has been the cause of the practical extermination of species of birds; but public opinion was finally aroused to check it. The demand for furs is leading to similar results. Many other species naturally perish before the continued onslaught of civilization, by means of which the native haunts are destroyed. We must protect that which we

need to grow for our own use. It is inevitable that the animal creation, as a whole, shall recede as the earth is subdued to man. But too often this creation has fallen long before its time — fallen as a result of unnecessary killing.

All the foregoing remarks are meant to illustrate what I believe to be an enlarging vision respecting our own place in the world. The point of view is shifting. The spiritual factors have increasingly more influence in shaping the course of our evolution. The emancipation of which I have spoken — the release from the necessity of taking life — will come, if at all, as a result of our enlarging spiritual outlook rather than as a result of agitations concerned with questions of diet or with any mere propaganda. It is said, on the other hand, that the conformation of man's teeth shows that a flesh diet is necessary, but this only indicates what our evolution has been, not what it will be. The evolution will come slowly, but whatever it may be, we have reason to believe that our points of contact with the nature-world will strengthen and multiply.

VI

THE POETIC INTERPRETATION OF NATURE

MERRILY swinging on brier and weed,
  Near to the nest of his little dame,
Over the mountain-side or mead,
  Robert of Lincoln is telling his name:
    Bob-o'-link, bob-o'-link,
    Spink, spank, spink;
Snug and safe is that nest of ours,
Hidden among the summer flowers.
    Chee, chee, chee.

Robert of Lincoln is gaily drest,
  Wearing a bright black wedding-coat;
White are his shoulders and white his crest.
  Hear him call in his merry note:
    Bob-o'-link, bob-o'-link,
    Spink, spank, spink;
Look what a nice new coat is mine,
Sure there was never a bird so fine.
    Chee, chee, chee.

Robert of Lincoln's Quaker wife,
  Pretty and quiet with plain brown wings,
Passing at home a patient life,
  Broods in the grass while her husband sings:

Bob-o'-link, bob-o'-link,
Spink, spank, spink;
Brood, kind creature; you need not fear
Thieves and robbers while I am here.
Chee, chee, chee.

Modest and shy as a nun is she;
One weak chirp is her only note.
Braggart and prince of braggarts is he,
Pouring boasts from his little throat:
Bob-o'-link, bob-o'-link,
Spink, spank, spink;
Never was I afraid of man;
Catch me, cowardly knaves, if you can!
Chee, chee, chee.

Six white eggs on a bed of hay,
Flecked with purple, a pretty sight!
There as the mother sits all day,
Robert is singing with all his might:
Bob-o'-link, bob-o'-link,
Spink, spank, spink;
Nice good wife, that never goes out,
Keeping house while I frolic about.
Chee, chee, chee.

Soon as the little ones chip the shell,
Six wide mouths are open for food;
Robert of Lincoln bestirs him well,
Gathering seeds for the hungry brood.

Bob-o'-link, bob-o'-link,
Spink, spank, spink;
This new life is likely to be
Hard for a gay young fellow like me.
Chee, chee, chee.

Robert of Lincoln at length is made
Sober with work, and silent with care;
Off is his holiday garment laid,
Half forgotten that merry air:
Bob-o'-link, bob-o'-link,
Spink, spank, spink;
Nobody knows but my mate and I
Where our nest and our nestlings lie.
Chee, chee, chee.

Summer wanes; the children are grown;
Fun and frolic no more he knows;
Robert of Lincoln's a humdrum crone;
Off he flies, and we sing as he goes:
Bob-o'-link, bob-o'-link,
Spink, spank, spink;
When you can pipe that merry old strain,
Robert of Lincoln, come back again.
Chee, chee, chee.

From Complete Works of William Cullen Bryant.
Published by D. Appleton & Co.

This was the exercise that the children were having as I visited the school on a June morning. It was the new old song by which Bryant is

remembered of the country boy and girl. The children had seen and studied the bobolink. They had heard the liquid rattle of his song. They had seen the nest in the grass. They had watched for the Quaker wife. They had seen the purple-flecked eggs. They knew that Robert of Lincoln would soon leave them. The poem touched their hearts, and they knew the bobolink better.

With enthusiasm I related the experience to my friend, the teacher of natural history in the college. He checked my ardor. He saw only danger in such teaching. It tends to looseness of ideas. It makes the mind discursive. It does not fix and fasten the attention on the subject-matter. It is unscientific. The child could learn poetry by the yard, he said, and yet not know how many toes the bobolink has, nor the shape and size of its wings. The pupil gains no comparative knowledge of bird with bird. The poem is untrue. The bobolink is not "drest": he has no clothes. He has no wife: he is mated, not wed.

I could only reply that the bobolink's toes have little relation to men's lives, however much they may have to bobolinks' lives; but the bobolink may mean much to men's lives. To a man studying ornithology—and I wish there were more—the toes are important; but these men are desirous of technical information, whereas I am seeking a fresh and firmer hold on life. To be sure, I should study the bobolink before I studied the poem; but I should want a real bobolink, not a stuffed specimen. If I were obliged to choose between

lessons on stuffed bobolinks and the poem, I should take the poem : there is more bobolink in it.

I like Bryant's lyric because it catches so much of the life of a bobolink. A scientific description could tell the story better, but only ornithologists read scientific descriptions. Yet I have always wished that the poet had told the whole story. The poem tells us of the life of the bobolink ; but after the breeding season is past, the birds gather in flocks in the rice-fields and reeds of the South and are then known as rice-birds and reed-birds. In great numbers they are slaughtered for the market, and thereby the bobolink does not become an abundant species in the North. May we not add :

Far in the South he gathers his clans,
  Nor thinks of the regions of ice ;
Too early yet for housekeeping plans,
  He rev'ls and gluttons in fields of rice.
    Rice-bird, bob-o'-link,
    Spink, spank, spink ;
Hunter is waiting under the bloom,
Robert of Lincoln falls to his doom.
    Chee, chee, chee.

Spring comes : swinging on brier and weed,
  Near to the nest of his little dame,
Over the mountain-side and mead,
  Another proud groom is telling his name :
    Bob-o'-link, bob-o'-link,
    Spink, spank, spink ;
The meadow belongs to wife and me—
Life is as happy as life can be.
    Chee, chee, chee.

This is the age of fact, and we are proud of it. But it may be also the age of the imagination. Fact is not to be worshiped. The life that is devoid of imagination is dead; it is tied to the earth. There need be no divorce of fact and fancy; they are only the poles of experience. What is called the scientific method is only imagination trained and set within bounds. Compared with the whole mass of scientific attainment, mere fact is but a minor part, after all. Facts are bridged by imagination. They are tied together by the thread of speculation. The very essence of science is to reason from the known to the unknown.

There can be no objection to the poetic interpretation of nature. It is essential only that the observation be correct and the inference reasonable, and that we allow it only at proper times. In teaching science we may confine ourselves to scientific formulas, but in teaching nature we may admit the spirit as well as the letter. If I were making a teacher's curriculum for the study of nature, I should include a course in English poetry. With pupils, however, one must be careful to have the poem exactly appropriate to the subject and the occasion. One may not make a list of poems that are always to be used by teachers of nature-study for specified topics. The choice of the poem should lie with the particular teacher or the pupils. These poems should be used sparingly, and not at all when the teacher himself does not have poetic feeling by means of which to interpret

them. Better no poems whatever than to have manufactured sentiment.

In our day of science people seem to be afraid of sentiment. The scientist forbids us to personify; and this is well. But this spirit may be carried so far as to forbid figures of speech and to condemn parables. Speech cannot be literally accurate. Even astronomers say that the sun sets, but we know that it does not. The trouble with much of the sentiment is that it gives us a wrong point of view. To say that a potato-plant works all the season in order to provide for its offspring the next year is said to give a wrong conception of the plant because it implies motive. But does this picture mislead any one? Everybody knows that a potato-plant has no brains. Everybody knows that the statement conveys a truth. Under certain conditions I believe that it is perfectly justifiable. If it is not, then I may not say that a potato has eyes. Much of the objection to statements of this kind is mere quibbling. But, on the other hand, all such allegories must be true in spirit and in their teaching. Much of the current writing of plants and animals, by which human motives are implied, is productive of harm; but we should distinguish between metaphor, or mere literary license, and an untrue point of view. The ultimate test is whether the reader is lead to believe what is not true. An animal or a plant may be represented as telling its own story without misleading any one, even as a character in a novel may speak in the first person; we need not imply human motives or human

points of view in these cases: there remain only the questions as to whether this is really good literary taste, and whether it is the most efficient way to reach the audience for which it is intended. In general, a direct and lucid presentation, without circumlocution, is to be preferred; and this direct method allows of the full expression of sentiment and the poetic impulse.

I protest against that teaching of nature which is mere sentimentalism, which makes the "goody-goody" part of the work so prominent that it becomes the child's point of view. Interest in things themselves should be the primary motive; sentiment comes chiefly as a result. But if there is danger of making sentiment too prominent, there may be equal danger in insisting on a perfunctory scientific point of view.

The spirit of science lends itself well to song. The concrete is not unpoetic. If in this day we apostrophize and personify nature less, we have improved in the spirit and intimacy of our song. The point of view gradually has shifted from human interest in natural things to the things themselves.

VII

AN OUTLOOK ON WINTER

In the bottom of the valley is a brook that saunters between oozing banks. It falls over stones and dips under fences. It marks an open place on the face of the earth, and the trees and soft herbs bend their branches into the sunlight. The hang-bird swings her nest over it. Mossy logs are crumbling into it. There are still pools where the minnows play. The brook runs away and away into the forest. As a boy I explored it but never found its source. It came somewhere from the Beyond and its name was Mystery.

The mystery of this brook was its changing moods. It had its own way of recording the passing of the weeks and months. I remember never to have seen it twice in the same mood, nor to have got the same lesson from it on two successive days; yet, with all its variety, it always left that same feeling of mystery and that same vague longing to follow to its source and to know the great world that I was sure must lie beyond. I felt that the brook was greater and wiser than I. It became my teacher. I wondered how it knew when March came, and why its round of life recurred so regularly with the returning seasons. I remember that I was anxious for the spring to come, that I

might see it again. I longed for the earthy smell when the snow settled away and left bare brown margins along its banks. I watched for the suckers that came up from the river to spawn. I made a note when the first frog peeped. I waited for the unfolding spray to soften the bare trunks. I watched the greening of the banks and looked eagerly for the bluebird when I heard his curling note somewhere high in the air.

Yet, with all my familiarity with this brook, I did not know it in the winter. Its pathway up into the winter woods was as unexplored as the arctic regions. Somehow, it was not a brook in the winter time. It was merely a dreary waste, as cold and as forbidding as death. The winter was only a season of waiting, and spring was always late.

Many years have come and gone since then. My affection for the brook gave way to a study of plants and animals and stones. For years I was absorbed in phenomena. But now mere phenomena and things have slipped into a secondary place, and the old boyhood slowly reasserts itself. I am sure that I know the brook the better because I know more about the things that live in its little world; yet that same mystery pervades it and there is that same longing for the things that lie beyond. I remember that in the old days I did not mind the rain and the sleet when visiting the brook. I was not conscious that they were not a part of the brook itself. It was only when I began to dress up that the rain annoyed me. I must make a proper appearance before the world. From that time, the

brook and I grew further apart. We are coming together again now. It is no misdemeanor to get wet if you feel that you are not spoiling your clothing. One's happiness is largely a question of clothes.

But the brook is one degree the better now just because it remains a brook all winter. The winter is the best season of the four because there is more mystery in it. Things are hidden; yet there is a new and strange spirit in the air. There are strange bird-calls in the depths of the still, white woods. There are strange marks in the new-fallen snow. There are soft noises when the snow drops from the trees. There are grotesque figures on the old fence. There is the warm brown pathway of the brook still winding up between oozing banks. In the spring there are troops of flower-gatherers along the brook. In the summer there are fishers at the deep pools. In the fall there are nut-gatherers and aimless wanderers. In the winter the brook and I are alone. We know.

Most of us, I fear, look upon winter with some feeling of dread and apprehension. It is to be endured. This feeling is partly due to the immense change that comes with the approach of winter. The trees are bare. The leaves are drifting into the fence-rows. The birds have flown. The deserted country roads stretch away into leaden skies. The lines of the landscape become hard and sharp. Gusty winds scurry over the fields. It is the turn of the year.

To many persons, however, the dread of winter, or the lack of enjoyment in it, is a question of

weather. We speak of bad weather, as if weather ever could be bad. Weather is not a human institution, and is not to be measured by human standards. There is strength and mighty uplift in the roaring winds that go roistering over the winter hills. The cold and the storm are a part of winter, as the warmth and the soft rain are a part of summer. Persons who find happiness in the out-of-doors only in what we call pleasant weather, do not really love nature.

We speak of winter as bare, but this is only a contrast with summer. In the summer all things are familiar and close; the depths are covered. The view is restricted. We see things near by. In the winter things are uncovered. Old objects have new forms. There are new curves in the roadway through the forest. There are steeper undulations in the footpath. Even when the snow lies deep on the earth the ground-line carries the eye into strange distances. You look far down into the heart of the woods. You feel the strength and resoluteness of the framework of the trees. You see the corners and angles of the rocks. You discover the trail that was lost in the summer. You look clear through the weedy tangle. You find new knot-holes in the tree-trunks. You penetrate to the very depths. You analyze, and gain insight.

Many times in warm countries I have been told that the climate has transcendent merit because there is no winter. But to me this lack is its disadvantage. There are things to see, things to

do, things to think about in the winter as in the spring. There is interest in the winter wayside, in the hibernating insects, in the fret-work of the weeds against the snow, in the strong outlines of the trees, in the snow-shapes, in the cold deep sky. To many persons these strong alternations of the seasons emphasize and punctuate the life. They are the mountains and the valleys. The winter makes the spring worth while.

The lesson is that our interest in the out-of-doors should be a perennial current that overflows from the fountain that lies deep within us. This interest is colored and modified by every passing season, but fundamentally it is beyond time and place. Winter or no winter, it matters not: the fields lie beyond.

PART III

INQUIRIES

SOME PRACTICAL INQUIRIES AND SOME WAYS OF ANSWERING THEM

PRACTICAL problems confront the teacher. However well he may understand the theory and however fully he may agree with it, a new difficulty arises every time that he attempts to teach. A child will ask a question that a philosopher cannot answer; but on every question the teacher must have a point of view. I frequently speak to teachers on means of teaching nature-study. For the time they are pupils and they ask questions: I am obliged to take a point of view, and some of these opinions I have jotted down at the time. Some of them are here reprinted, not because they may be correct, but because they may be suggestive.

How shall I know what subjects to choose?

Let the children select the subject now and then. Let them choose and collect the specimens. But they may bring things of which the teacher knows nothing. So much the better! These are sometimes best for nature-study. They leave the largest interrogation point. From any subject the teacher can develop a fact. If he does not know the interpretation, say so; the pupils will be the more interested. The teacher will not lose stand-

ing by the confession, for he is honest. People lose standing by pretending to know what they do not know and by being caught at it. The child is relieved to know that there is something yet to be discovered. Verily, the subjects of which the teacher does not know are useful in the teaching; and then, they are so common!

But if the child choose the material, the subject will lack continuity: what then?

Nature is not consecutive except in her periods. She puts things together in a mosaic. She has a brook and plants and toads and bugs and the weather all together. Because we have put the plants in one book, the brooks in another, and the bugs in another, we have come to think that this divorce is the logical and necessary order. I wonder!

Then would you give no heed to continuity?

How much or how little continuity will depend on the teacher and the circumstance. With children, the temptation is to have too much rather than too little continuity. First of all, we must develop the child's experience. The higher the grade, the more the topics may be correlated and coordinated. I doubt whether a closely graded nature-study is really nature-study at all. For children, I believe in that continuity and consecutiveness which relate the subject to its place and season. In April, correlate the work with the opening of the spring; in October, with the coming of winter. Compare the nature-study of June with that of May. With living things,

the cycle of the year is the fundamental continuity.

How shall I make a start?

Persons hesitate, fearing that they will make a mistake. A teacher asked me the other day where he should begin with nature work. He had been considering the matter for two or three years, he said, but did not know how to undertake it. I replied, Begin! Head end, tail end, in the middle —but Begin! There are two essential epochs in any enterprise—to begin, and to get done.

For the first lesson, choose the natural object that you know most about. Every teacher has sufficient knowledge of one subject to afford one good nature-study lesson. The second lesson will take care of itself.

If you are thinking of starting off a movement in all the schools in a city or a commissioner's district or in a county, first choose your teachers. Choose those that have enthusiasm and "good spirit" and that are not tied hand and foot to customary methods. Choose the fearless teachers —the ones that are anxious to arouse the pupils even though they do not do it by the book. Then give these teachers one good lesson yourself. Or, if you cannot give the lesson, put in their hands one good nature-study leaflet. Choose the leaflet as you would a teacher—for cheery outlook, energy, and directness of expression. Choose a leaflet that sends the teacher directly to nature; you do not want stories. Choose the leaflet that has snap and spirit, not mere information. It

should be attractive in subject-matter and in mechanical execution. Never put a cheaply illustrated and poorly printed leaflet before a pupil. Remember that children are optimists, and that they want the best in both teacher and leaflet. Let the teachers study the object and the leaflet until the subject is mastered. When the teacher is full of the subject, he cannot help teaching.

If you are fortunate enough to have the starting of a nature-study movement for a State or other large territory, buy a small quantity of one of the best leaflets you can find. If you do not have the money, borrow it. Send a note to the newspapers to the effect that any teachers who wish to take up nature-study work may write you for literature and advice. All the rest will work itself out. Money will come from some source. Soon you will be publishing leaflets of your own; but be careful who writes them.

Beware of putting your trust in leaflets alone. Follow them up with correspondence and other personal work. The leaflet will not work of itself. It will soon be forgotten unless you keep the spirit and the enthusiasm alive. Organize your teachers and your children. Keep at it.

Is not subject-matter the first consideration?

Perhaps. Subject-matter is important, but the teaching faculty is equally so. Has it ever occurred to you that many of the most useful school text-books are made by persons who are not most proficient in the subject-matter? It were better if the books were better; but good or bad, they

are useful because they are practicable and usable. The successful text-book is successful because the author knew the teacher and the pupil. Where is the person who knows equally well the subject-matter, the teacher, and the pupil?

Subject-matter and enthusiasm are all-important and coordinate. They are to be obtained at the same time. But the importance of subject-matter is often misunderstood. It is not necessary that one have a wide range of knowledge, but rather that he should know one thing or a few things thoroughly, so far as he goes. It may not be necessary to go deep, but it is important to do well as far as we go.

Would you teach heat, light and physics as nature-study topics?

No, not as these subjects are ordinarily taught. They are usually taught as abstractions, having little relation to the pupil's life. There are many phenomena in these fields that are within the range of the pupil's experience, and these may be useful in the hands of a good teacher. The best results will be secured, in the hands of most teachers, by confining nature-study rather closely to biological fields and to those earth-objects that are most intimately associated, in the child's mind, with the fields. I would not exclude the other topics; but I once knew a teacher who began nature-study for children with a disquisition on the conservation of energy!

Would you teach "practical" and "useful" things?

Yes, if the things are such as appeal to the child

and are adapted to the conditions. No, if they do not meet these requirements. In other words, I should not choose them merely because they are "practical" or "useful to man." I should want the child to have a wider horizon and a truer view of nature. The prime requisite is that the child become interested in the being itself, whether that being chance to be "injurious" or "beneficial." Many of the "useful" and "harmful" things are eminently adapted to nature-study work, however, from the fact that they are common; but we must be careful not to dwarf the sympathies by purposely confining our work to those things that have "use."

Would you teach objects that the child cannot see and determine for itself?

No! Right here is where much of our nature-study effort shoots wide of the mark. The child should be set at those things that are within its own sphere and within the range of its powers. Much so-called nature-study teaching is merely telling the child what some man has found out. Bacteria, sheep's brains, life-histories of difficult insects, chemical changes in germination, pollination, yeast, fermentation—these and a hundred others are beyond the child's realm.

How much apparatus do I need?

Perhaps none; possibly some. The apparatus and the teaching may easily be made too perfect. Any elaborate scheme or equipment is likely to be depressing to those who are less fortunately situated. A laboratory in a teacher's training-school may be so extensive and complete that the

graduates do not take up efficient work for themselves, feeling that they cannot do so without much equipment. Make the most of common and simple subjects in nature-study. Leave the extensive outfits to teachers of science. The two pieces of apparatus that you most need are an aquarium for things that live in water and a terrarium for those that live on land. These become "scenes of life" and supplement the outdoors.

Is it "thorough"?

"I do not believe in your nature-study movement," a high school teacher said, "for it does not lead to thoroughness in school work." I asked her to explain what she meant by thoroughness. She took me to her schoolroom. It was a laboratory. Pupils of sixteen and seventeen were studying the cell. For three weeks the pupils had been working on the cell, and they were to continue the work for a month. This, she told me, was thoroughness. I agreed with her. "But of what value is this knowledge to the pupil?" I asked. "The pupil knows the cell," she replied, "and to know the cell is to understand the structure and growth of the plant."

I, too, believe in thoroughness, but there is one thoroughness of mere details and another thoroughness of the broader view. So far as mere thoroughness is concerned, one kind may be as perfect as the other. Thoroughness consists only in seeing something accurately and understanding what it means. We can never know all that there is to be learned about any object. Even the

months' work on the cell was a mere smattering. Men spend their lives in studying the cell, and then do not understand it. What most school-teachers mean by thoroughness is only drill in details. In its proper time and place, I believe in this kind of drill in mere detail, but its place is not with youngsters.

But the great objection to my teacher's work on the cell, as I see it, is the fact that it means little or nothing to the pupil's life and is a mere acquirement. I have little sympathy with what is known as "practical" knowledge as a means of training youth—for that spirit which would teach only those things that can be turned into direct use in money-getting; but I would put the child in contact with its own life, and the teacher who does this teaches with thoroughness whether he teach much or little.

But will not this nature-study be called superficial?

No doubt. A botanist told me that I was doing superficial work. Judged from the view-point of science-teaching, he was right; but I was not teaching science. Judged from the view-point of the child, I hope he was wrong. One is not superficial merely because he does not delve deep into subject-matter. He should try to be accurate so far as he goes. What is superficiality in the specialist may be commendable thoroughness in the layman. Even the specialist is satisfied with the most superficial knowledge in subjects outside his specialty. It is notorious that his knowledge of men and of business, for example, is superficial.

This charge of superficiality is usually only the opinion of a different point of view. This is well illustrated in the critical reviews of elementary text-books of science. Books that have been criticized severely by the scientist have been accepted with enthusiasm by the schoolmaster. The primary merit of a school-book lies in its pedagogy rather than in its science. Statements in such books have two values—the teaching value and the science value. Too often the reviewer thinks only of the science value.

Of course there is danger of superficiality. There is this danger in everything; but the danger is inherent in the person, not in the subject. Solid work is as necessary in nature-study as in anything else. It is not play. Professor E. B. Tichener writes as follows of what he considers to be the three dangers in nature-study: "The first is that, in striving for sympathy with nature, we run into sentimentality. The second is that, in avoiding fairy tales, we run into something ten times worse —if indeed fairy tales are bad at all; I mean a pseudo-psychology of the lower animals. And the third is that, in trying to be exceedingly simple, we become exceedingly inaccurate."

But do you think that this nature-study will make investigators?

That depends on what you mean by an investigator. If you mean an inquirer, then I say that nature-study will develop the trait to perfection. If you mean one who shall discover and record new truth by means of painstaking investigation, then I

answer that nature-study will not detract from such attainment. Neither does it lead directly to that end, and this is its merit. To be an investigator is to be a professionalist or specialist; and professionalists should be developed late in the school life from the few who show talent in that direction. Nature-study is for every one, and therefore is fundamental; scientific investigation is for the few, and therefore is special. If nature-study opens the sympathies natureward, it will also increase the appreciation of science. Too much are our college students taught to make their reputations as investigators. In fact, the student who goes to college or university to study usually thinks only or mostly of investigation—of his science. I wonder whether a science is not worth acquiring as a specialty for the sake of teaching it? May not reputations be made as high-class teachers of entomology or botany, even without ever publishing a bit of technical research? It would be better if the teacher were also the investigator, but there are few persons who can make happy union of the two ideals.

Will not this nature-study tend still further to overburden the school?

The overburdening of the school hours is due as much to the fact that the old subjects do not give way as that new ones are introduced. The old schools had too little variety. Perhaps the new ones have too much congestion. Just now we are in an intermediate stage between the old and the new. Nature-study is not a new subject clamoring

for a place: it is a rational and natural point of view asserting itself. Its spirit will eventually pervade and vitalize all school work. It is some comfort to know that our school hours are now full. They cannot be fuller. If other things are added, old subjects must drop out. It is a struggle for existence. By introducing spontaneity and personal enthusiasm, nature-study should relieve the congestion rather than increase it. If nature-study becomes a burden, it is likely to be because the teacher tries to teach too much and makes too hard work of it.

Shall we teach the child to collect, and thereby to kill?

How much or how little the collecting habit shall be encouraged must be determined for each case by itself; but, in general, the child should be taught to respect the life of every creature. Collecting should be a mere incident, particularly with very young children, and it should be encouraged only when it has some definite purpose. The wanton spirit always must be suppressed. I do not like to encourage young children to "catch things" for the mere excitement of catching them. Study the habits of things as they are. I have little sympathy with the development of mere sentimentalism regarding the life of animals and plants; but it is a safe principle, with children, to let everything live its own life. Discourage the spirit of the hunter.

Would you tell the child the names of the things?

Certainly, the same as I would tell him the name

of a new boy or girl. But I should not stop with the name. Nature-study does not ask finally "What is the thing?" but "How does the thing live?" or "What does it do?" or "How did it get here?" or "What can I do with it?" The name is only a part of the language that enables us to talk about the object. Tell the name at the outset and have the matter done with. Then go on to vital questions.

Would you begin by first reading to the child about nature?

No, not in the school as a part of nature-study work. The reading should come after, not before. Order will gradually come out of experience. The child should first come in contact with things rather than with ideas about things. This is the natural order. Animals come before zoology, plants before botany, fields and rocks before geology, words before language, religion before theology. Experience should come before theory.

Now that there are so many nature-books, how shall I choose the most useful one?

Only by finding out what you want. The multitude of books may be confusing, but the greater the number the greater is the chance that you will find one to your liking. Some persons deplore the making of many books, because they then have more difficulty in choosing; but the time has already passed when one book, or even two, can satisfy a good teacher. The teacher may not be able to purchase several books, but the school should supply a reasonable number. In these days

the library is part of the equipment of the school. There is a general feeling that a new book—particularly a new school-book—is made for the purpose of displacing some other book. I once wrote a book. It seemed to occupy a field for which one of my best friends also had written. This friend wrote that perhaps I was right and he was wrong. I replied that I hoped I was right, but that this did not imply that he was wrong. I hope that we are both right. There is more than one point of view. Teachers sometimes deplore the number of text-books. As a matter of fact, we need more rather than fewer; thereby is there greater likelihood that every teacher can find a book to his liking. I do not believe that we should have uniform methods of teaching any subject in all parts of the country. When one text-book satisfies everybody, it is because everybody is uncritical and unpersonal.

How shall I acquire sufficient knowledge to enable me to teach nature-study?

In the same way that you acquire other knowledge—by means of work and study. There is no way by which you can dream it or absorb it. There is no excellence without labor. The teacher should know more than he attempts to teach.

Yet, you must not magnify the importance of mere knowledge. The ambition to teach and the love of doing for a child are the fundamental requisites. My own love of nature was given direction and purpose by a teacher who knew very little about nature; but she knew how to touch a

boy's heart. Fill yourself full of some subject, however small it may be. When you cannot hold it longer, teach. Yes, you may make mistakes. But every one makes mistakes, even with the best of pains. Every person who, by teaching or writing, has helped the world to a higher plane, has said or written errors. Our books contain them. Every person, and particularly every teacher, should make all effort to be accurate; but if we wait till every possibility of error is removed, the world's work will never be done. Many a man sacrifices his chances of usefulness for fear of making a mistake. Many investigators are so intent on the accuracy of mere details that they overlook the value of enthusiasm and point of view.

The best way to get the knowledge is to work for a time with a good teacher; but be sure that this teacher has enthusiasm and human sympathy as well as knowledge. Read books and leaflets. Above all, go into the fields and study the objects themselves. Do not wait until you are thoroughly equipped before you begin to teach, else you will never begin. When you have begun and your pupils begin to press for answers, you will learn. When you discover that you have made an error, admit it and acknowledge it. The pupil will respect you. Honesty always wins respect.

It is not necessary that you become a scientist in order to teach nature-study. You simply go as far as you know, and then say to the pupil that you cannot answer the questions which you can-

not. This at once elevates you in the pupil's estimation, for the pupil is convinced of your truthfulness, and is made to feel—but how seldom is the sensation!—that knowledge is not the peculiar property of the teacher, but is the right of any one who seeks it. It sets the pupil investigating for himself. The teacher never needs to apologize for nature. He is teaching simply because he is an older and more experienced pupil than his pupil is. This is the spirit of the teacher in the colleges and universities to-day. The best teacher is the one whose pupils the furthest outrun him.

Is it best to have a professional nature-study teacher to go from school to school?

This is a local and administrative problem. Ideally, it is best that every teacher handle the nature-study, because nature-study is not merely another subject, but it is a spirit and an attitude, and its effect is greatest when it is most continuous. In practice, however, some teachers will be sure to develop special aptitudes for the work, and these persons should be retained for this particular effort. The best talent should be employed for nature-study, as for anything else.

Should the parts of a school-garden be apportioned to pupils, or should the work be done in common?

In practice this becomes largely a question of administration: sometimes one thing can be done and sometimes the other. Ideally, the parts should be apportioned in the real laboratory school-garden. Thereby is the sense of proprietorship cultivated and the stimulus of emulation aroused.

It is always advisable, when it can be arranged, to provide for some culmination or focus of the season's work in the nature of a flower-show or vegetable-show; or, the children may be allowed to sell the products of their gardens or to give them to hospitals or other worthy objects. This individuality of interest can be easily maintained in the plot-garden, but it is more difficult in the ornamental garden in which the plants are grown in continuous borders.

In order to indicate how some of the questions are attacked by those who are engaged in the work, I reprint an article on the Whittier School-Garden, by Miss Jean E. Davis, that appeared recently in *Country Life in America*:

"What is believed to be the largest school-garden in the United States is to be found in Virginia at the Hampton Institute for Negro and Indian youth, where it forms part of the equipment of the Whittier Training School—the practice-school of the institution. Two acres of ground are given up to the garden, the larger part being divided into two hundred individual plots, varying in size from four by six feet for the pickaninnies of the kindergarten, to eleven by fifteen feet for the oldest boys and girls. Each plot is owned, for the time being, by two children, who enter into partnership and share equally in the work as well as in the profits of the garden—spading, raking, planting, hoeing, harvesting with their own hands, and using the products in their own homes or selling them to their neighbors. The young farmers are not given

carte blanche, however, in regard to the kind of crops they shall raise or their position in the beds. The supervision of the work is in the hands of one person—the director of the agricultural department of the Institute—who decides what vegetables and flowers shall be planted and how they shall be arranged. This plan serves to give symmetry and order to the garden as a whole, and adds materially to the educative value of the work. Most of the plants selected are such as are easily cultivated and such as mature rapidly, like lettuce, radishes, nasturtiums and marigolds; though peas, beans, cabbage, spinach and tomatoes are also cultivated. The gardens are made and planted both in the fall and in the spring, the crops sown in spring being cared for during the long summer vacation by volunteers.

"The beds are separated from each other by paths one foot wide, and are arranged for the different classes in sections, having two-foot paths between them. Extra plots, six feet wide, extending the full length of each section, are used for overflow work by pupils who are exceptionally quick and energetic. Strawberries and raspberries are sometimes permitted in these beds. Another opportunity for work out of the usual routine is afforded by a space of three-quarters of an acre which is reserved at the rear of the garden for the purpose of teaching the larger boys how to use a horse and plow. In order that the esthetic side of gardening may not be neglected—the cultivation of a sense of beauty being esteemed of equal impor-

tance with practical instruction in agriculture—a large lawn has been placed at the entrance, while border beds of ornamental flowers form the other boundaries.

"But if school-gardening were confined to the making of gardens, the planting of seeds and the cultivation of crops, beneficial as these experiences might be, it would still fall far short of accomplishing the end desired in introducing this subject into school courses. It would soon degenerate into either play or drudgery. To give it dignity and interest, and to make it of practical value in later life, the gardening is supplemented or preceded by simple experiments in the class-room illustrating the principles of germination and plant-growth; and a study is made of seed dispersion, the comparative value of soils and the work of beneficial and injurious insects. Seeds are planted in window-boxes, the seedlings affording material for language and drawing lessons before being transplanted into the outdoor beds. The decorative value of flowers, leaves and berries is considered, and the children are encouraged to make gardens at their homes from which they may gather bouquets of flowers for their dinner-tables.

"The results of two years' experience in teaching gardening and nature-study at the Whittier School are most gratifying. While at first it was necessary to use compulsion with some of the older girls, and the little ones merely considered anything 'good fun' that took them out of doors, they now without exception look forward with eager enthusiasm to

'gardening day,' which comes twice a week to each of the four hundred. Large crops have been gathered and proudly carried home; seeds have been in demand for home gardens, sixty or more of which have been made in the neighborhood; and last spring children to the number of one hundred and thirty volunteered to cultivate the gardens during the summer vacation. In the home-gardens there has been great diversity of crops. Besides the usual school plants, children have raised wheat, corn, pumpkins, sweet and Irish potatoes, and also many kinds of flowers. A wholesome rivalry has sprung up between the owners of adjoining beds in the school-garden, and pride in the appearance of the school-grounds has been stimulated. An interest in birds and insects, and an appreciation of the beauty of wayside flowers and other common things, have been developed; and the roughest children have been made more gentle by handling the beautiful flowers that they have grown, the result of their own care and patience. A regard for the property and rights of others is among the results of this cooperative gardening, also an appreciation of the advantages of working together, and a certain forbearance and loyalty to one's partner, all of which are lessons of inestimable value, especially to colored children. When we add to these unconscious influences of school-gardening the conscious self-respect and self-reliance that come from the ability to produce from the soil something of one's very own, it will be admitted that this sub-

ject is worthy of an honorable place in the course of study of our common schools, of which the Whittier School is only a type."

Why should this nature-study be confined to the schools?

It should not be confined to schools. Too often it is so limited because we are in the habit of delegating the training of our children to a professional class of teachers. The home should be the most perfect school, and the parents should be the ideal teachers. In the increasing complication of our lives, however, the division of labor forces the children more and more from the home-training into the school-training; therefore it is increasingly important that we give good heed to the maintenance of good schools. But even yet the home-training should afford an auxiliary to the school-training. There should be more than one common bond of method and purpose. One of these bonds should certainly be the desire to put the child into sympathetic relation with its own necessities: this is nature-study, for, to a very great degree, the child is the creature of its environments.

I believe in the value of education by means of literature and history and science and art; but if I were confined to one means I should choose that education that would lead me to love the things that I see and the work that I do day by day. This outlook I should want to impress on my children; but I could not impress it by any mere intellectual means. It is an affair of the heart; and if I do not live it I cannot teach it.

What shall we do with the children in the summer vacation?

This is an exceedingly important question and very difficult to answer. The teacher has no control of the child during this period. He can suggest what the pupil may do, but the probability is that the pupil will merely drift.

I am convinced that there is a great loss of efficiency in the overlong and undirected summer vacation for both child and youth. The colleges are beginning to feel this, as shown in the development of four-term systems. The summer schools are protests against an idle summer. Herein is where the farm boy gets much of his efficiency for the battle of life—in the fact that he has no long periods of enforced idleness, laziness and emptiness. He is kept at work. He grows up with an appreciation of the value of time. He knows what industry is and what it brings. Steady effort and application become the warp and woof of his life. The town boy of the upper and middle class, on the other hand, is likely to become accomplished in feats of idleness. One-fourth his time is mere vacation, or, rather, mere vacancy. He is handicapped when later he comes squarely against the realities of life.

I believe in a long vacation if the time is occupied in some well-directed effort. I am glad to see the development of the summer-camp idea for both boys and girls, where, under competent and sympathetic guidance, with firm but kindly discipline and something like Spartan fare, they

are led to see and to know the nature in which they are. In such camping-out experiences the youth comes hard against actualities. He gathers materials that are his own and that become a part of his capital throughout his life. He comes to his own conclusions and to think for himself, not merely to absorb his knowledge and opinions from teachers and books. In later life he may never have another opportunity to get this actual experience.

I wonder how many persons ever saw the sun rise?

Will not this nature-study work interfere with school discipline?

That all depends on what you mean by "discipline." If you mean perfect "order," the child sitting erect with clasped hands, then nature-study work may annoy you. If you mean only that the child is well-behaved, obedient and quiet, then no ill result should come from the nature-study effort. Nature-study should supply some of the "busy work" between the regular periods. Really, the best means to secure good discipline is to keep the child busy and interested. "Discipline" is then a mere incident.

The greater number of mischievous and refractory children can be interested in some piece of personal work or investigation. The boy who is "licked" at home and punished at school is likely to spend his time midway between the two; and yet he may be easy to reach if only he is understood.

Shall I correlate the nature-study work with other work?

This question can be answered only for particular cases. In general, correlation is an advantage to all subjects concerned; however, I fear that in much of the correlation the nature-study part is little more than a name. If the nature-study can be kept genuine—a real study of natural objects at first hand—I see no danger in correlation. The correlation usually is of greater benefit to the other subjects than to nature-study.

Nature-study work can be correlated with various other school work, notably with essay writing, drawing and geography teaching. The very first essential in essay writing is to have something from one's own experience to say. Assigned topics are usually "hard" at best. Let the child write of what it has seen or done that day or yesterday—the butterfly, the tadpoles in the pond near by, the plants growing in its garden, the fish in the aquarium, the peaches on the tree by the barn, the little world of life in the terrarium, the woodchuck that lives under the stone fence. If the child has had no such experience, why not begin by assigning him a living topic to look up and report on in writing?

We need to be unusually careful to see that the writing is not exotic to the child. Avoid the model of mere nature-study "stories" about things; these stories tell what others have found out. They inform and instruct and entertain, rather than educate and set the child to work.

We stifle the desire to write if we first lay down

rules and formulas as to how to write. Let the child have a personal experience; then allow it to write. Did you ever have a pupil who could not write a composition, but who could write a letter that was full of originality and personality? Why could it write the one and not the other? To often, I fear, we prevent our children from writing by trying to make them write. Of what use is writing, anyway, if it is not self-expressive? So, let the child have something real and personal to write about. No subject is too mean. Then when the child has written, throw away the blue pencil and suggest tactfully how the piece may be improved here and there. Do not hinder the child.

I well remember my first "composition." For days I had tried to think of a "subject." I had importuned father and mother and friends. "Winter," "Spring," "The pen is mightier than the sword," "The pleasures of farm life," "Shakespeare"—all had equal terrors. Rapidly the days melted away, and to-morrow the composition must be ready, and yet of all the well-sounding subjects not one seemed to present a way of escape. The teacher—God bless her!—learned of my plight. She asked me what was the best "time" I had had last summer. Of course I knew—the time when we all went blackberrying, with all of us rolled into the bottom of the wagon-box that went bumping and rattling over the stones and grinding through the sand, when we crept through the deep cool woods and then came into the "clearing" where the skidded logs were covered with the

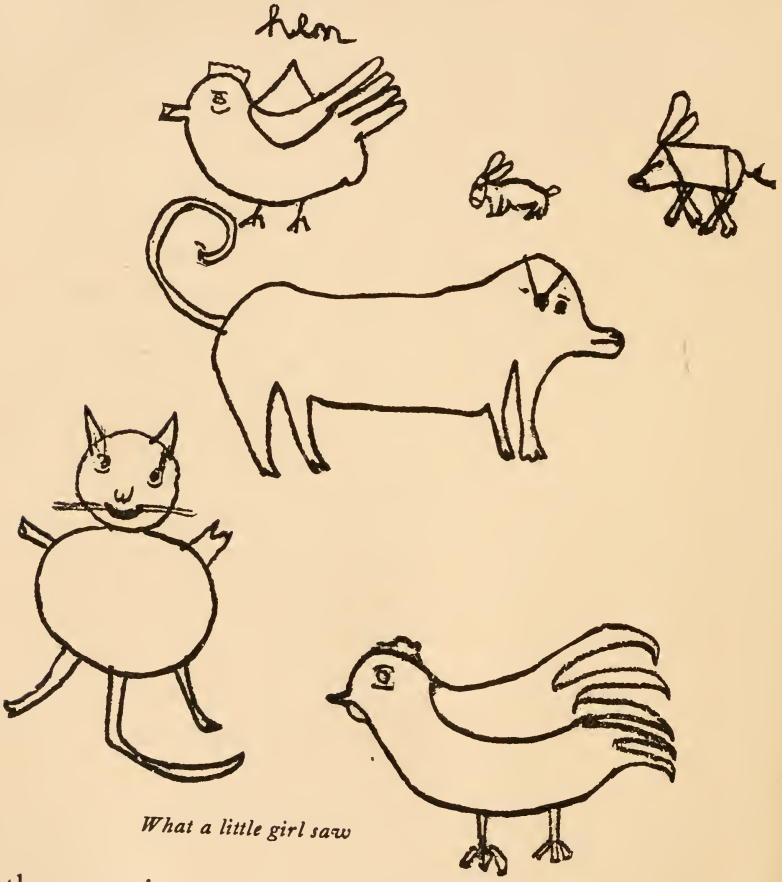
tangle of berries and berries—of course I knew! With what wild delight I told her! and then she said, "Just write that down and it will be your composition." From that day until this I hope I have written only on those things that are dear to me.

I have a similar word to say about drawing. The other day I heard Mrs. Comstock speak on this subject before a convention of teachers. She is herself an artist. She said that there are two kinds of drawing—the kind that is the child's self-expression, and the kind that makes an artistic picture. It is natural for every child to make lines and marks to express what it sees or experiences; but when these lines and marks do not conform to the ideals of grown-ups, we discourage the effort and the child ceases to draw. Considered as the effort of the child to express itself, no drawing can be "poor." Mrs. Comstock put on the board a copy of a drawing from a child's pad, and it was as follows:

"The impression that a man made on the child—face, arms, legs"

We all laughed; but we were told that this was no caricature, but the impression that a man made on the child—face, arms, legs.

More than words, the drawing may show what the world means to the child, even allowing for all



What a little girl saw

the error in clumsiness with pencil. Do you not wonder how the world looks to the little girl in the second grade who made all these drawings and sent

them to Uncle John? Would you not like to take her on your knee and have her explain them to you?

Primarily, drawing is a means of expressing what we see and feel; now and then a person develops the ability to make a picture that pleases others, and he becomes an artist. Primarily, our interest in the external world is one of sympathy and personality; now and then a person develops the ability to make discoveries and to record them, and he becomes a scientist.

Correlation of nature-study and drawing should give excellent results to both subjects. The nature-study should afford objects in which the pupil is genuinely interested; the drawing should aid in focusing the observation and making it accurate. Drawing should be encouraged primarily for the purpose of discovering what the child really sees. As the child sees more, and with greater accuracy, the drawings improve. So the drawings become an approximate measure of the progress of the pupil. Do not measure the drawings merely as drawings, or from the artist's point of view. We are likely to dwell so much on the mere product of the child's work that we forget the child.

Too early in the school life do we begin to make pupils mere artists and literators. First the child should be encouraged to express himself; then he may be taught to draw and to compose.

Is nature-study on the wane?

Real nature-study cannot pass away. We are children of nature, and we have never appreciated

the fact so much as we do now. But the more closely we come into touch with nature the less do we publish the fact abroad. We may hear less about it, but it will be because we are living nearer to it and have ceased to feel the necessity of advertising it.

Teaching may not be nature-study merely because it is so called. A superintendent told me that he had forbidden nature-study in his schools. I asked him what the work had been. He said that it was the dissecting of cats. A publisher told me that nature-study is waning. I asked why he thought so. He replied that his nature-study books were not selling as well as they did. I told him that I was glad.

Much that is called nature-study is only diluted and sugar-coated science. This will pass. Some of it is mere sentimentalism. This also will pass. With the changes, the term nature-study may fall into disuse; but the name matters little so long as we hold to the essence.

All new things must be unduly emphasized, else they cannot gain a foothold in competition with things that are established. For a day, some new movement is announced in the daily papers, and then, because we do not see the head lines, we think that the movement is dead; but usually when things are heralded they have only just appeared. So long as the sun shines and the fields are green we shall need to go to nature for our inspiration and our respite; and our need is the greater with every increasing complexity of our lives.

Would you advise me to take up nature-study teaching?

Yes, if you feel the "call" to it; otherwise, no. I would not have every teacher teach nature-study any more than I would have every one teach grammar. Every pupil should have nature-study, under one name or another; but he should receive his inspiration from the teacher who himself is so full of the subject that he teaches with spirit and with cheerfulness.

PROPERTY LIBRARY
N. C. State College